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Flora Neotropica 1994: progress in bryophytes and lichens

Rob Gradstein

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FLORA NEOTROPICA is intended to be a complete, monographic flora of the tropical American region. The monographs are written by specialists and published for the "Organization for Flora Neotropica" (OFN) by The New York Botanical Garden. As of 1994, over 65 monographs have been published and more than 150 botanists have offered to submit monographs in the future. A complete list of monographs published can be obtained from the Executive Director of FLORA NEOTROPICA, Dr. Enrique Forero, New York Botanical Garden, Bronx, N.Y. 10458-5126, U.S.A.

Cryptogamists interested to contribute a monograph to the series are invited to write to the Deputy Director of Cryptogams, Dr. S. Rob Gradstein, at the address given above.

In 1994, two new monographs on cryptogams have been published in FLORA NEOTROPICA. The moss family **Stereophyllaceae**, by Robert R. Ireland and William R. Buck and treating 16 species in 7 genera, appeared as Flora Neotropica Volume 65 (50 pp., 17 illustr., 6 maps, US \$ 12.50). The monograph of the liverwort family **Lejeuneaceae**, **tribes Ptychantheae and Brachiolejeuneae**, by S. Rob Gradstein, was pub-

lished as Flora Neotropica Volume 62 (220 pp., 37 illustr., 17 maps, US \$ 31.50). This volume, awarded the 1994 Augustin-Pyramus de Candolle Prize for the best monograph in plant systematics, deals with 22 genera and 65 species. The two volumes may be ordered, as usual, from the Scientific Publications Department, New York Botanical Garden, Bronx, N.Y. 10458-5126, U.S.A., telephone 718-817-8721, FAX 718-817-8842.

Several offers of new monographs have been received in the course of 1994. Sinikka Piippo, Botanical Museum, Helsinki, will revise the important hepatic family **Lepidoziaceae** (50-100 spp., in 15 genera). She has been doing fieldwork in Ecuador in November/December for the purpose and hopes to have a manuscript ready within 5-6 years. P. Tixier, Museum of Natural History, Paris, has offered to treat the liverwort genus **Cololejeunea** (Lejeuneaceae) and has

submitted a manuscript earlier this fall.

As to mosses, we have received the important offer of Richard Zander, Buffalo Museum of Science, Buffalo, N.Y., to monograph the neotropical **Pottiaceae**. This is one of the largest bryophyte groups in the region, with an estimated 200+ species in 54 genera. Completion of this treatment will be a long-term undertaking. Jonathan Shaw, Ithaca College, N.Y., has expressed an interest to do the **Pohlioideae** (family Bryaceae) and Hans Kruijer, Rijksherbarium, Leiden, will submit a treatment of the neotropical **Hypopterygiaceae** (3 species, in 2 genera), as part his world-wide monograph of the family which is nearing completion. Maria Schiavone, Instituto "Miguel Lillo", Tucumán, Argentina, will deal with the genus **Ptychomitrium** as a contribution to the Grimmiaceae monograph undertaken by Claudio Delgado (Mexico).

Further progress

The manuscript on the **Fissidentaceae** (100+ species) by Ronald Pursell (Pennsylvania State University) is expected to be ready for submission in 1995.

Efrain de Luna (Instituto de Ecología, Xalapa, Mexico) is polishing his monograph of the neotropical **Hedwigiaceae** (mosses) - which was prepared as a dissertation at Duke University in

1992 - to make it suitable for publication in Flora Neotropica and hopes to have part of the text ready for pre-reviewing later this year.

Work on the moss family **Hypnaceae** by a group of Japanese workers headed by H. Ando, University of Hiroshima, is progressing well and it is expected that the manuscript will be ready by the end of 1995.

Ongoing projects

Heike Hofmann is currently working on a taxonomic revision of the genera *Homalothecium* and *Palamocladium* (Brachytheciaceae). Her address is: Institut für Systematische Botanik, Universität Zürich, Zollikerstrasse 107, CH-8008 Zürich, Switzerland.

Summary of Bryophyte contributions to Flora Neotropica as of 1994**Musci**

Amblystegiaceae (21 spp.) — R. Ochyra (KRAM)
 Aulacomniaceae (1 sp.) — S.P. Churchill (NY)
 Bartramiaceae (25 spp.) — D. Griffin III (FLAS)
 Brachytheciaceae
 Brachythecium (30 spp.) — K. McFarland (TENN)
 Bryaceae
 Pohlioideae — J. Shaw (Ithaca)
 Calymperaceae (55 spp., 2 genera) — W.D. Reese, FN Monograph 58, 1993
 Dicranaceae
 Campylopodioideae & Paraleucobryoidae (84 spp., 7 genera) — J.-P. Frahm, FN Monograph 54, 1991
 Leucoloma (5 spp.) — C. Lafarge-England (ALTA)
 remaining groups — J.-P. Frahm (DUIS)
 Ditrichaceae (ca. 50 spp.) — R. Seppelt (Kingston, Tasmania)
 Fissidentaceae (150 spp.) — R.A. Pursell (PAC)
 Grimmiaceae
 Grimmia (30 spp.) — C. Delgadillo M. (MEXU)
 Ptychomitrium (ca. 15 spp.) — M. M. Schiavone (LIL)
 Racomitrium (ca. 5 spp.) — R. Ochyra (KRAM)
 Hedwigiaceae s. str. (20 spp.) — E. de Luna (XAL)
 Hookeriaceae
 Lepidopilum and allied genera (ca. 45 spp.) — S.P. Churchill (NY)
 miscellaneous genera — B. Allen (MO)
 Hypnaceae (ca. 60 spp.) — H. Ando, M. Higuchi, N. Nishimura (Japan) & R.R. Ireland (Ottawa)
 Hypopterygiaceae (3 spp.) — H. Kruijjer (L)
 Leucobryaceae s.l.
 Leucobryum, *Steyermarkiella* (10 spp.) — T. Yamaguchi (Univ. of Ryukyus, Japan)
 Octoblepharum (10 spp.) — N. Salazar Allen (PMA)
Leucophanaceae (2 spp.) — N. Salazar Allen (PMA), FN Monograph 59, 1993
 Meesiaceae (1 sp.) — S.P. Churchill (NY)
 Mniaceae (ca. 10 spp.) — T. Koponen (H)
Neckeraceae (10 spp., 2 genera) — I. Sastre-de Jesus, Monograph submitted
 Orthotrichaceae (125 spp.)
 Macromitrioideae — D.H. Vitt (ALTA)

Orthotrichoideae — J. Lewinsky (KUO)

Plagiotheciaceae (6 spp.) — W.R. Buck & R.R. Ireland, FN Monograph 50, 1989

Polytrichaceae (30-40 spp.) — S.P. Churchill (NY), J. Hyvönen (H) & M. Menzel (B)

Pottiaceae (ca. 200 spp. in 54 genera) — R. Zander (BUF)

Pterobryaceae

Pirella (15 spp.) — A. Newton (US)

Rhizogoniaceae (10 spp.) — S.P. Churchill (NY) & C. Matteri (BA)

Seligeriaceae (3 spp.) — D.H. Vitt (ALTA)

Sematophyllaceae (100+ spp.) — R.R. Ireland & W.R. Buck (NY)

Sphagnaceae — H. Crum (MICH)

Splachnaceae (15 spp.) — A. & T. Koponen (H)

Stereophyllaceae (16 spp., 7 genera) — R.R. Ireland & W.R. Buck, FN Monograph 65, 1994

Thamnobryaceae (15 spp.) — I. Sastre-de Jesus (Puerto Rico)

Hepaticae

Cephaloziaceae (25 spp., 9 genera) — J. Vána (PRC)

Geocalyceae (35 spp., 3 genera) — J.J. Engel (F)

Gymnomitriaceae (15 spp., 4 genera) — J. Vána (PRC)

Jungermanniaceae (50 spp., 11 genera) — J. Vána (PRC)

Lejeuneaceae

Aphanolejeunea (10 spp.) — T. Pócs (EGR)

***Cololejeunea* (25 spp.) — P. Tixier, Monograph submitted**

 Lejeuneae (ca. 250 spp.) — B. Thiers (NY), R. Grolle (JE) & S.R. Gradstein (U)

Ptychantheae & Brachiolejeuneae (65 spp., 22 genera) — S.R. Gradstein, FN Monograph 62, 1994

Lepidoziaceae (50-100 spp., 15 genera) — S. Piippo (H)

Marchantiales (ca. 85 spp.) — coord. H. Bischler (PC)

Asterella (ca. 12 spp.) — D. Long (E)

Cyathodium (ca. 5 spp.) — N. Salazar Allen (PMA)

Dumortiera (2 spp.) — N. Salazar Allen (PMA)

Marchantia (8 spp.) — H. Bischler (PC)

Plagiochasma (8 spp.) — H. Bischler (PC)

Riccia (38 spp.) — S. Jovet-Ast (PC)

Radulaceae (ca. 70 spp.) — K. Yamada (Japan)

ANTHOCEROTAE (ca. 30 spp.) — G.G. Hässel de Menendez (BA)

New publications

Sérgio, C., Casas, C., Brugués, M. & Cros, R. M. 1994. *Lista vermelha dos briófitos da Península Ibérica [Red list of bryophytes of the Iberian Peninsula]*. Instituto da Conservação da Natureza (ICN) & Museu, Laboratório e Jardim Botânico, Universidade de Lisboa (MLJB). ISBN 972-8083-30-0 (ICN) & 972-96491-0-3 (MLJB). 45 pages. Available from: Museu, Laboratório e Jardim Botânico, Universidade de Lisboa, Rua da Escola Politécnica 58, P-1294 Lisboa Codex, Portugal. Price: c. 1,800 Portuguese Escudos (\$).

With this publication, another two European countries have an up to date overview of the situation for their bryofloras. Here we find a list summarising the situation for endangered bryophytes in Spain, Portugal and the entire Iberian Peninsula, respectively. To include the entire Iberian Peninsula, rather than assessing the situation in Spain and Portugal separately, is of course how you should proceed in a case like this although national interests often make biologically more sound approaches difficult in conservation work. In the red list, information regarding threat category in the respective areas, and regarding which species are endemic to the Iberian Peninsula or Europe is also provided. Unfortunately, several species which occur also on Madeira or the Canary Islands are included among the European endemics, although these areas belong to Africa. Examples include *Brachythecium dieckii*, *Hypnum uncinulatum*, *Isothecium algarvicum*, *Lepidopilum virens* (*Tetrastichium virens*) and *Neckera cephalonica*. One good piece of news that I am able to provide here is that *Lepidopilum virens* is probably not extinct on the Iberian Peninsula since it was collected there only a few years ago (by M. Ahrens & N. Hakelier; N. Hakelier, personal information, material in S).

Besides the red list, the distribution of the species among the different geographical areas (Spain, Portugal, entire peninsula), among mosses and hepatics, among different habitats, according to different general climatic regions, and according to which biogeographic region

they have their main distribution in, is discussed. The situation in the Iberian Peninsula is also compared with the situation in the rest of Europe. In total 399 of the 1044 species occurring on the Iberian Peninsula are considered rare or threatened. Finally, a list of the species that are not threatened in Spain and Portugal is provided. Thus, this publication is also a check-list of the species occurring in these countries and on the Iberian Peninsula. [L.H.]

Frey, W., Frahm, J.-P., Fischer, E., Lobin, W. 1995. *Die Moos- und Farnpflanzen Europas. Kleine Kryptogamenflora Bd. IV, 6.ed., Stuttgart (Fischer), 426 pp. with 149 plates. Hardcover. Price DM 78 (ca. US\$ 50).*

The only book covering all bryophytes and ferns of Europe, published in 5 editions by Helmut Gams between 1942 and 1973, was totally new written by Wolfgang Frey (liver- and hornworts), Jan-Peter Frahm (mosses), Eberhard Fischer and Wolfram Lobin (ferns).[JPF]

Pilegaard, K. 1994. *Deposition of airborne metals around the lead-zinc mine in Maarmorilik monitored by lichens and mosses. Meddr on Grønland, Biosci. 43, 20 pp. Price 66.- DKK. Available from: Geografforlaget, Fruerhøjvej 43, DK-5464 Brenderup, Denmark.*

The deposition of heavy metals around the Pb-Zn mine in Maarmorilik (Greenland) was monitored during the years 1979-1990 by analyses of concentrations in *in situ* lichens (*Cetraria nivalis* and *Umbilicaria lyngei*) and higher plants (*Rhododendron lapponicum*). Concentrations of the metals Ag, As, Cd, Cu, Hg, Pb, Sb and Zn decreased with increasing distance from the mining and milling complex. The spread was most pronounced west of Maarmorilik. Exposed Pb-Zn mineralizations in the area were found not to influence the overall deposition pattern. Airborne pollution with Cd, Pb and Zn was monitored with suspended *Sphagnum*-bags during a period with ship-

Changes of editorship

Jan-Peter Frahm has resigned from his position as editor of *Bryophytorum Bibliotheca*, a duty carried out by him since 1986. His task will be taken over by his co-editor S. Rob. Gradstein, who will take full responsibility as editor of the series. Authors interested in publishing a monograph or other major book-type of publication in *Bryophytorum Bibliotheca* should contact the editor, Dr. S. R. Gradstein, Herbarium, University of Utrecht, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands, Fax +31-(0)30-518061.

S. Rob Gradstein, at the same time, will step down as scientific editor of *Tropical Bryology*, a journal which he has founded together with Jan-Peter Frahm in 1989. His task as editor will be taken over by Bill Buck. The change of editorship will be effective from volume 11 onwards. All manuscripts dealing with bryophytes, for publication in *Tropical Bryology*, should from now on be addressed to Dr. W. R. Buck, The New York Botanical Garden, Bronx, N. Y. 10458-5126, U. S. A. For subscriptions on *Tropical Bryology* and conditions of publication, please consult a recent issue of the journal or write to the managing editor, Dr. J.-P. Frahm, Botanisches Institut, Universität Bonn, Meckenheimerallee 170, D-53115 Bonn, Germany, Fax +49-(0)228-733120, E-mail frahm@uni-bonn.de

loading of concentrates and compared to a period without this activity. There was a strongly increased deposition or airborne Cd, Pb and Zn during periods of ship-loading. The primary sources of pollution were the concentrate conveyor and ship-loader. *Sphagnum*-bags were also used to monitor the effects of remedial actions carried out in the mining town. Analysis of the concentrations of Pb in *Cetraria* during the years 1979 to 1990 showed that pollution during the last years was only about half as large as during the early years. This decrease is attributed to pollution abatement carried out at the mining complex.

Bryological Research by the British Antarctic Survey

Dr. Ronald I. Lewis Smith, Head of Plant Ecology and Environment Section, British Antarctic Survey, Madingley Road, Cambridge CB3 0ET, U. K. (FAX ++44-223-62616, e-mail RILSM@pcmail.nerc-bas.ac.uk).

The following note is written in response to the editors' plea in *The Bryological Times*, No. 80, October 1994, for news and notes on bryological research. My copy of *Bryological Times* has just reached me at the British Antarctic Survey's Rothera Station, at the southern end of the Antarctic Peninsula, where I am awaiting a Twin Otter flight to Alexander Island to carry out a six-week field study of the bryoflora, bryophyte colonisation and the effect on bryophytes of the high UV-B levels being experienced directly beneath the ozone "hole" in this remote location. I thought this might be a good opportunity to inform bryologists of what the B. A. S. has done and is doing in the way of bryological research in the southern polar regions.

Since the vegetation of the Antarctic is predominantly of a cryptogamic nature, there being only two species of phanerogams, a major component of our terrestrial biological programme concerns bryophyte ecology and physiology and, formerly, systematics. Although numerous plant collections had been made by members of the Falkland Islands Dependencies Survey (which was renamed British Antarctic Survey in 1962) in the late 1940s and 1950s, the BAS Botanical Section did not come into existence until the early 1960s. The person responsible for establishing the botanical programme was Dr. Stanley W. Green, then at Birmingham University, and who, many years later founded and edited *The Bryological Times*. It was Stanley who built up a taxonomic team working primarily on Antarctic and sub-Antarctic bryophytes, particularly of the maritime Antarctic region and South Georgia (although he was also author of the "Vascular Flora of South Georgia"). This led to the creation of one of the first plant taxonomic

databases, later to become known as the Antarctic Plant Database (APD; on ORACLE) of the British Antarctic Survey's herbarium (AAS). From the early 1960s until the early 1980s Stanley's group published several dozen papers on bryophyte taxonomy, mainly in two series, "A Synoptic Flora of South Georgia Mosses" and "Notes on Antarctic Bryophytes", published in *British Antarctic Survey Bulletin*. In 1986 Stanley's wife Dorothy published "A Conspectus of the Mosses of Antarctica, South Georgia, the Falkland Islands and Southern South America" (see "Best Book Buys", *Bryological Times*, No. 80). As stated by Dale Vitt, this is a primary literature source for this region of the world. Noteworthy members of the British Bryological Society who formerly worked with BAS, besides the Greens, include Dr. R. E. Longton, Dr. M. E. Newton, Dr. N. J. Collins, Dr. B. G. Bell, Dr. G. C. S. Clarke, Dr. P. J. Lightowers and Dr. S. Russel. Unfortunately, with the demise of taxonomy as a founded research field in the early 1970s, the highly productive systematic work of BAS was terminated, although papers continued to be published for the next decade. Government-supported research councils and universities alike were forced, very reluctantly, to cease such research, particularly in cryptogamic botany. The resultant decline in teaching of this subject in universities has had dire consequences for the subject.

Fortunately, however, the "Rio Summit" drew attention to the urgent need for taxonomic research in order to assess the world's biodiversity in all plant and animal groups, especially the lower organisms. Consequently, there has been a slight rejuvenation in bryological research and funding in the past few years. BAS has benefited from this by

succeeding in having a Data and Resource Centre Manager (Dr. Helen J. Peat) appointed who, among other duties, is responsible for curating the herbarium, operating the APD and compiling an Antarctic Cryptogamic Bibliography database. Unfortunately, we are still unable to carry out systematic work in BAS, but material and data printouts are available on request (contact Dr. Peat at BAS, FAX ++44-223-62616). We are very pleased to encourage bryologists (and, indeed, lichenologists) to make use of this facility, and to visit BAS should they wish to work in our herbarium on any aspect of the collections. The herbarium holds over 15,000 specimens of bryophytes from Antarctica (mainly the maritime Antarctic, i. e. Antarctic Peninsula, South Shetland, South Orkney and South Sandwich Islands, but also with many specimens from continental Antarctica), sub-Antarctic South Georgia and Iles Crozet, and temperate Falkland Islands and southern Patagonia (although most of the latter were transferred to the herbarium at Edinburgh Botanical Gardens). The APD holds data for these and about another 5,000 moss records pertaining to collections from these regions. A similar number of specimens and records of lichens are held in AAS. Our GIS links allow us to access similar databases worldwide. Although well documented and curated, some of the specimens remain undetermined, but progress is being made in rectifying this situation. Plans are being prepared to embark on a major revision of the Antarctic moss flora over the next few years.

Systematic bryology has been only a small part of BAS' botanical research. The major element of our work involves field research at various sites, mainly in the maritime Antarctic and South Georgia. These have been and continue

to be primarily of an ecological and ecophysiological nature, with strong emphasis on the bryoflora and bryophyte-dominated ecosystems. For over 30 years these studies have covered a wide range of topics and resulted in very many publications, as well as several PhDs and MScs. This research has concentrated on addressing problems concerning ecological and physiological processes, particularly the functioning of major community types or ecosystems, colonisation of recently deglaciated terrain, survival strategies and, very recently, the effect of increasing temperatures and ultraviolet-B radiation on these processes. More specifically from a bryological point of view, our current or recent research includes: community ecology and classification; species distribution in relation to environmental parameters; ecosystem modelling; soil propagule banks and colonisation; recovery from natural and human perturbation; reproductive strategies; spore and vegetative propagule dispersal (including current study of trans-oceanic dispersal); moss peat development and its Holocene palynological record; nutrient dynamics and decomposition; water relations; growth and dry weight production; photosynthesis and respiration; biochemistry with particular regard to low temperature survival and cryoprotectants; photoprotective pigments with particular regard to UV-B. In addition, much of the BAS terrestrial microbiological and invertebrate research is undertaken in moss-dominated vegetation, and much of this is closely linked to the botanical studies. Many of these biological projects involve monitoring microclimate in the vegetation as an integral and vital component of the investigations.

Environmental impact assessments are now an important aspect of all human activities in the Antarctic, and critical consideration is given to any possible perturbation to vegetation, no matter how sparse. BAS has appointed an environmental officer (Dr. J. R. Shears) to carry out the assessments, in

consultation with myself and other scientists. All national organisations pertinent research programmes in the Antarctic are required by law to adhere to the Protocol on Environmental Protection to the Antarctic Treaty. Activities, including proposed scientific research, which may have a damaging effect on the flora, vegetation or environment, can no longer be approved. Numerous areas have been designated Specially Protected Areas and Sites of Special Scientific Interest to protect special biological features in particular localities, several of which have been designated specially because of their exceptional bryophyte vegetation. Management plans for newly proposed sites have to be approved by the Scientific Committee for Antarctic Research before being recommended to the Antarctic Treaty Consultative Parties: final approval is at government level. There are no known endangered bryophyte species in the Antarctic or Sub-Antarctic. Several species appear to be very rare or are known to have very restricted distributions but, as yet, none justifies special protection status.

Most of this research has been carried out at long-term field research sites at South Georgia (54°S) and Signy Island (South Orkney Island, 61°S); some studies have also been undertaken at sites in the South Shetland Islands (62°S), along the western side of the Antarctic peninsula (63°-68°S) and also in collaboration with other nations elsewhere in Antarctica. However, a new BAS programme of terrestrial biological research has commenced at a much more continental site on Alexander Island at 72°S. Depending on the nature of the research project, scientists spend from three to 30 months at an Antarctic research station, or revisit the station for more than one summer. The station laboratories are well equipped and the projects reasonably funded. However, to maximise the productivity and efficiency of our research programme, we have had many collaborations with specialists from other countries, either working with them at their

national Antarctic research station and/or with them working with BAS scientists at one of our stations. This is often the only way research requiring expensive sophisticated equipment or specialist expertise can be achieved and, in accordance with the aims and policy of the Antarctic Treaty, this system of collaboration and co-operation is extremely successful and rewarding. It should be made known that several other countries are doing research with particular emphasis on Antarctic mosses, namely Argentina, Australia, Brazil, Japan and Poland.

As far as BAS is concerned, their commitment to terrestrial research in the Antarctic has been assured for our next quinquennial forward plan, i. e. 1995-2000. There will continue to be strong emphasis on bryophytes and moss-dominated ecosystems, particularly in the fields of ecophysiology, colonisation processes, survival strategies, and responses to environmental change; taxonomic research will be maintained through collaborations with specialists outside BAS. Anyone wishing further details about BAS' research and Antarctic bryology in general should contact the author.

Dissertations

Anne Breuil-Sée, Paris, France, successfully defended her Ph. D. thesis "Ultrastructural criteria for anhydrobiosis and reviviscence in thalli of the hepatic genus *Riccia* L. (Marchantiales, Bryophyta)" on 17 January 1995.

The address of Anne Breuil-Sée is: Laboratoire de Cryptogamie, E. P. H. E., 12 rue Buffon, F-75005 Paris, France.

Death

Iwao Nagano, professor in plant taxonomy and ecology at the Saitama University died 11 November 1994 during his term as president of the Bryological Society of Japan.

The realisation of conservation programmes: minutes of the final discussion, held at Institute für Systematische Botanik der Universität, Zürich, 8 September 1994.

Chairman: Rob Gradstein.

Panel: Henk Greven (spokesman for psychological group workshop), Royce Longton (spokesman for juridical & political group workshop), Hans-Joachim Mosler (psychological expert), Marie Pilch-Giering (juridical expert), Geert Raeymaekers (EU expert!).

R. Gradstein welcomed all to the final session of the Symposium and introduced the members of the panel. The purpose of this session was to learn about the two workshop sessions that had taken place earlier, which had covered the juridical, political and psychological aspects of bryophyte conservation, to reach some conclusions and to make some resolutions if necessary.

The spokesmen of the working groups then gave brief summaries of the workshop sessions.

A. Psychological aspects: Henk Greven

H. Greven applied the six points itemised earlier by H.-J. Mosler to bryophytes

1. Gain attention.

- ‘Coming out’ of bryologists: We must not be afraid to say we are bryologists rather than ‘botanists’ or ‘biologists’. This would be a positive attention-gaining action.
- Mass media. We need to get attention of the mass media, using good, attractive material. For example, there is a good Norwegian documentary film about bryophytes. This could easily be used on TV in other countries.
- Education, development of schools programmes, etc. Teachers should be encouraged to use bryophytes in (for example) standard microscopic

studies of plant cells.

- Exhibitions, popular books, tourist information. For example, the ECCB could produce a booklet of species that occur in all European countries.
- Exchange of information and educational material.

2. Make goals understood.

Our goals must be made clear. They are likely to be different in different countries and regions. The major ones are:

- Conservation of biodiversity
 - Conservation of declining species
 - Conservation of processes
- Conservation of very rare species is probably more difficult to communicate to politicians and others.

3. Generate a positive attitude.

Target groups: children, adults.

The suggestions made in point 1. (above) also apply here. Psychological processes should also be considered.

4. Engender willingness to act.

Target group: politicians, administrators, managers, resident populations. Influence legislation.

Where there is already a nature conservation law, it is usually possible to add bryophytes to lists of protected species.

5. Influence behaviour.

Target groups: biologists, non-biologists.

For example, guidelines (along the lines of the British Bryological Society Code of Conduct) could be produced. Bryologists who are also conservationists *must not* collect the very rare spe-

cies.

Information should be targeted at consumers in order to influence behaviour.

Publicity.

6. Achieve continuity of behaviour.

The momentum of the process must be maintained, once begun.

For example, monitoring of conservation programmes: ‘blue lists’ containing species that have been taken out or Red Lists because they are no longer threatened.

Open discussion was invited on the above points.

Lars Söderström emphasised (re. point 2.) that it is important to distinguish between goals and means. Goals should be broader, and should be held in common throughout Europe, whereas means to achieve them may be very different in different regions. The means must all go in the same direction (i.e. towards the same goals), even if the roads are different.

Tomas Hallingbäck suggested adding ‘conservation of species special to a region, such as endemics’ to our goals (point 2.).

H.-J. Mosler said that communities (of people) can to some extent be treated in the same way as individuals. If one community is convinced of the need for bryophyte conservation, it will be an example to others. Therefore, concentration of conservation effort in a region could be directed at a single community (e.g. a village).

Johannes Vogel pointed out that a mass movement cannot be created within a small community. It would therefore be better to treat ‘politicians’

as a community, or target group, so that they can communicate the message to others. Also, most politicians will need 'rewards' for considering bryophyte conservation.

H.-J. Mosler agreed, saying that a typical reward might be something like a prize in a 'Best Kept Village' competition.

J. Vogel was concerned that this kind of activity can lead to mere lip-service being paid to conservation, with, for example, a certain percentage of land being devoted to conservation, but not the most important areas.

G. Raeymaekers felt that politicians should not be allowed to make our agenda. NGOs should make their own agenda and act upon it, only telling politicians about it after it has been made, and if necessary letting them take the credit for it. G. Raeymaekers went on to relate a useful example of how awareness of bryophytes could be heightened. The organisers of a moss-garden display in Belgium were looking, without success, for promoters. However, when combined with a bonsai display, promoters became interested and supported the project. Members of the public visiting the display came to see bonsai but left with an impression of the beauty of bryophytes!

Royce Longton said that there are at least some politicians who are genuine. Therefore, the approach should be dictated by the kinds of politicians involved.

After further brief discussion, the resolutions were agreed in principle, while the exact wording could be worked out later. The final resolutions are presented below (Appendix 1).

A supplementary resolution proposing protection for a specific important bryophyte site in Russia was proposed by Edi Urmi and accepted by the meeting. This is also presented below (Appendix 2).

Rob Gradstein thanked all delegates for their presentations and contributions, and closed the meeting.

(see also BT 80 for a summary of the other resolutions [Eds comment]).

Appendix 1. Resolutions made by ECCB following the Conservation of Bryophytes in Europe Symposium held in Zürich, 4-8 September 1994.

1. ECCB should request national authorities to include the sites listed in the European Bryophyte Site Register in the list of sites representing natural habitat types cited in Annex 1 of the Habitat and Species Directive, insofar as the 'important bryophyte sites' are covered by Annex 1 habitat types and are within the EU territory. National authorities should be requested to designate these sites as Special Areas of Conservation.
2. ECCB should as the scientific community to propose a strategy to promote the interests of plant conservation to be undertaken through the Cohesion Fund and the Structural Fund of the EU.
3. ECCB urges that all EU and national environmental legislation concerned, for example, with maintaining the quality of air, soil and water, and with disposal of waste, should make appropriate provision for the conservation of bryophytes and other plants and that such legislation should be implemented through sectorial policies concerned with matters such as energy, agriculture, industry, transport and tourism.
4. ECCB should seek to ensure that bryophytes and other non-vascular plants are given equal weight with vascular plants and animals in conservation legislation throughout Europe and elsewhere.
5. ECCB should collaborate with the IUCN legal programme to develop strategies aimed at ensuring that the judiciary and other authorities involved in enforcing environmental legislation are adequately trained in conservation biology, with particular attention to plant conservation.
6. ECCB and IUCN Specialist Group for Eastern Europe should offer to collaborate with administrative authorities, the Academies of Science in eastern European Countries and other relevant bodies, with the objective of developing the structures necessary to strengthen and enforce legislation aimed at conserving bryophytes and other plants.
7. ECCB recommends that funding agencies such as the World Bank and the EU Commission through its PHARE programme, should allocate a significant percentage of their development aid to nature conservation within their environmental programmes. It is recommended that the governments of all European countries should recognise the need to make adequate financial provision for measures designed to conserve bryophytes and other plants.
8. ECCB should collaborate with scientists from throughout Europe within its Action Plans for bryophyte conservation by offering to share expertise and in other appropriate ways.

Appendix 2. Supplementary resolution on the protection of Kutsa area, Russia

The ECCB Symposium, held in 1994 in Zürich on the conservation of threatened bryophytes in Europe, requests the competent authorities to give legal protection to the territory of Kutsa area (Murmansk Province, Russia).

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March 20-25. Workshop on Macaronesian Fissidentaceae. Place: La Laguna, Tenerife, Canary Islands (Spain). Further information: A. Losada-Lima, Departamento de Biología Vegetal (Botánica), Universidad de La Laguna, 38271 La Laguna, Tenerife, Islas Canarias (Esp.) Number of participants is limited to 20.

April 5-12. Spring field meeting at Ambleside, Cumbria. Further information from Peter Bullard. Work address: Cumbria Wildlife Trust, Cumbria, LA22 0BU Phone 05394 32476. Home address: 36 Castle Garth, Kendal, Cumbria LA9 7AT Phone 0539 732699.

June 17-22. Annual Meeting and Excursion of the Nordic Bryological Society on Jutland, Denmark. Further information from Kell Damsholt, Botanical Laboratory, University of Copenhagen, Gothersgade 140, DK-1123 København K, Denmark

July 29-August 3. ABLs Annual Meeting, Jasper National Park, Alberta, Canada. Further information from Dale H. Vitt, Department of Biological Sciences, University of Alberta, Edmonton, Alberta TG6 2E9, ph. (403) 492-3380; Fax (403) 492-1899.

August 7-12. IAB Biennial Meeting entitled Tropical Bryophytes: Biology, Diversity and Conservation. IAB Conference in Mexico City (see BT77). Contact C. Delgadillo, Instituto de Biología, UNAM, Apartado Postal 70-233, Del. Coyoacan, 04510 Mexico, D.F. Mexico, Fax (525)555-1760, email: moya@redvax1.dgsca.unam.mx.

August 29-September 2. IAB & IAL Symposium on Follicolous Cryptogams in Eger, Hungary. Further information from Dr. Edit Farkas, Institute of Ecology and Botany, Hungarian Academy of Sciences, H-2163 Vácátót, Hungary. Phone +36-27-360122/147, Fax +36-27-360110, E-mail: H7483FAR@ELLA.HU

September 18-21. XI Simposio Nac. Bot. Criptogámica. Further information from XI Simposio Nacional de Botánico Criptogámica, Departamento de Biología Vexetal (Botánica), Facultad de Biología, Universidad de Santiago de Compostela, 15706 Santiago de Compostela, España. Ph. (981) 563100, ext. 3263 or FAX (981) 596904.

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June-July (final date to be set later). Second International *Sphagnum* Field Trip and Symposium in New Jersey, New York and Quebec. Further information available at a later date.

August 5-8. To celebrate the 100th anniversary of the British Bryological Society, a symposium entitled 'Innovations in bryophyte research' will be taking place at the University of Glasgow. Contributions will be invited shortly. The BBS summer field meeting in west will take place immediately afterwards in the west and central Highlands.

October 8-12. International Symposium of Botanic Systematics and Plant Geography, Herbarium Haussmecht, Jena, Germany.