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Preface

The Taxonomic Databases Working Group for Plant Sciences (TDWG) is an international working group set up in 1985 by institutions and projects involved in major plant taxonomic databases to explore ideas on standardisation and cooperation. The work of the Group in establishing standards and exchange formats has gathered momentum, and reports of the 1985 and 1986 meetings attracted interest in the taxonomic community and amongst those establishing botanical databases.

In view of the large amount of valuable material presented and discussed at the third meeting, it was decided to publish the Report. This means it will reach a larger audience, and also be located more easily by those seeking it. The contents will act as a progress report alerting readers to what is going on and to standards and formats in preparation.

It has not, unfortunately, been possible to include the 21 documents circulated at the meeting; they amount to nearly 200 pages in total and are in many cases preliminary suggestions for standards that will be published when complete. These 21 documents are listed in Appendix 2 and copies are available at nominal cost from the TDWG Secretariat. Since the meeting, the first of the Plant Taxonomic Database Standards has now been published by the Hunt Institute (International Transfer Format for Botanic Garden Plant Records) and others will follow.

We are extremely grateful to Dr. F. A. Bisby, Dr. D. A. Sutton and Dr. G. F. Russell for the skilled and effective way in which they have produced the report of what was at times a very lively meeting, and to the Hunt Institute for undertaking publication.

V. H. Heywood
Chairman, TDWG

Introductory Remarks

Heywood, the chairman, welcomed new participants. He outlined the purpose of the Working Group in establishing a basis for international co-operation between the major taxonomic databases, and as a forum for discussing designs and standards. Cullen welcomed participants to Edinburgh on behalf of the Royal Botanic Gardens Edinburgh, BIOSIS, CABI International and IUCN (Conservation Monitoring Centre). Bisby explained changes in the agenda to allow certain proposals to receive detailed discussion in Session 1: these would be the standards proposed to TDWG for preliminary or final approval usually after initial discussion at the previous TDWG meeting.

Session 1: Standards

1.1 Procedural Discussion

Agreed: that the objective was to establish voluntary standards. These standards should be published and documented so as to be available for adoption by some or all of the wide
range of plant taxonomic databases as and when required. In particular the adoption of TDWG
standards in the data output and data exchange
from large or popular taxonomic databases
would encourage their widespread adoption.
The extent to which they actually succeeded
in becoming standards would depend on the
natural selection implicit in the voluntary
adoption: there would be no coercion.

Agreed: that particular TDWG member or-
ganisations would be encouraged to take re-
sponsibility for drawing up individual stan-
dards to meet the demands of TDWG and its
specialist subgroups. This was envisaged as a
continuing responsibility to deal with docu-
mentation and new versions after the publi-
cation of the standard but with TDWG or its
subgroups advising on the content, and
TDWG being the final arbiter.

Agreed: that each standard must be formally
adopted by TDWG at one of its meetings after
full consultation. As a minimum this con-
sultation would involve a preliminary discus-
sion of the standard at the previous TDWG
meeting, and circulation of final copies of the
standard to member organisations a month or
so prior to the TDWG meeting at which it
was proposed for adoption. In many cases there
would be further discussion by a TDWG
subgroup.

1.2 Standard Geographical System

Mackinder referred to earlier discussions (see
TDWG 1 and TDWG 2) of which the prin-
cipal points were:

i) that we seek a system which is simple
and easy to use;

ii) that we should use a hierarchy or series
of hierarchies in which defining
the middle levels equivalent to countries
presents the main difficulty;

iii) that ISO Countries (countries recog-
nised by the International Standards
Organisation) offer the only solution
that avoids political controversy.

He circulated a document (Draft Geograph-
ical Classification—Document 1) which iden-
tified problems with political and biologically
meaningful divisions of countries, and diffi-
culties with regional or continental areas.

Hollis introduced the system (ILDIS Ge-
ographical System—Document 2) proposed for
use in the ILDIS system. It is of interest to
TDWG both because it incorporates the prin-
ciples proposed by Mackinder, and because the
enumeration of countries and subdivisions
closely resembles that subsequently proposed
by a working group at K and proposed by
Brummitt. The system proposed for ILDIS
has a single hierarchy composed of:

i) top level (continents or regions);

ii) middle level (ISO Countries);

iii) bottom level (ISO Countries in their
entirety or subdivided wherever one or
more of the following rules apply):

1: ISO Countries with physically dis-
tant parts are subdivided (e.g. Spain
becomes peninsular Spain, Balearics,
and the Canary Isles);

2: Large ISO Countries are subdivided
into the next lowest political sub-
division (e.g. the states in contigu-
ous USA). An arbitrarily truncated
list of “large” countries is needed;

3: ISO Countries spanning two con-
tinents are subdivided into two parts
(e.g. Turkey is divided so that the
parts nest in different continents).

Document 3 gives examples of dividing ISO
Countries following these rules. The ILDIS
scheme would correspond to political units in
Bisby’s diagram (Aid to Discussion of Geo-
ographical Systems—Document 4) at levels 1
(squares), 3 (triangles) and 4 (squares).

Brummitt introduced the scheme devised at
Kew (A Proposed World Geographic Sys-


tems at Kew and requirements may well cover as wide a range as would be found amongst the full TDWG membership. The proposed system envisaged the simultaneous use of two distinct sets of countries: "political" countries and "botanical" countries. Political countries would be ISO Countries, and "botanical" countries would be botanically sensible units (see Document 6, Brummitt's list 1) such as those used in Flora Europaea, referred to as TBCs (Taxonomic Botanists' Countries). These sometimes involve aggregations of nations (e.g. Vatican City included in Italy), and sometimes aggregations of part nations (peninsular Spain, excluding Balearics and Canaries, with Andorra and Gibraltar). The two systems could be maintained in parallel if the distribution data was actually recorded for a new lower level referred to as a BRU (Botanical Recording Unit) listed by ISO Country in Document 7 (Brummitt's list 2), in a TBC, BRU, ISO Country gazetteer in Document 8 (Brummitt's list 3), and by TBC in Document 9 (Brummitt's list 4). The BRU was defined as the single set of nations and part nations needed so that the same data could be used to re-compose both the data for political countries and for botanical countries. Didelot pointed out that in set theory the BRUs would be the intersection of the political and botanical country sets. Brummitt also provided a higher classification of continents and subcontinents (Document 10, Brummitt's list 5).

Prior discussions between Brummitt and Hollis had established that there was in practice a close correspondence at level 4 in Bisby's diagram (Document 4) between the nations and part nations in the ILDIS system and the BRUs in the Kew system: the criteria for subdividing nations in the ILDIS system roughly corresponded to the cases where Brummitt thought parts of nations should go into different botanical countries. It thus became clear that the Kew and the ILDIS systems might be combined as in Bisby's diagram.

The middle-level triangles represent the ISO Countries of the ILDIS System and the political countries of the Kew system. The middle-level circles represent the botanical countries (TBCs) of the Kew system. The middle-level squares represent the nations and part nations of the ILDIS system (achieved by dividing ISO countries by the ILDIS rules) and are conceptually identical to the BRUs of the Kew system (achieved by dividing botanical countries using political criteria).

There followed discussion as to whether a combined Kew/ILDIS system along the lines of Bisby's diagram could become workable as a TDWG standard. The strength of the proposal was that it would allow databases following the standard to provide distributions by political countries, by botanical nations, or by both. However data could only be aggregated into one, the other, or both forms and remain exchangeable if it was originally recorded at the BRU level (level 4, squares, in Bisby's diagram). Consequently the real standard was the enumeration and usage of BRUs, and not the use of either political or botanical countries alone. It is therefore essential that whilst the published standard might enumerate the political and botanical countries at higher levels, only the BRUs constitute the standard.

There was much debate on the following:

— the compromise between a political, physical and phytogeographic system;
— the comparative benefits of a generalised simple geographical system, a complex gazetteer and a geographical information system (GIS);
— the issues of using latitude and longitude in specimen databases;
— the balance between political realities and botanical needs;
— the importance of exchanging geographical data at or below the BRU level.

Agreed: that Brummitt and Hollis be asked to draw up a proposed TDWG geographical
standard based on the combined Kew/ILDIS system, and to consult both a special TDWG subgroup and a geographically wide range of contacts for assistance in enumerating the areas. The standard should be a list of Basic Recording Units (BRUs) that exhaustively and exclusively covered the world land area using whole or subdivided ISO political countries. There should also be an indication of how these are aggregated to give the list of ISO Countries, and to form a list of Taxonomic Botanists’ Countries (TBCs). It was hoped the exercise would be complete within six months.

1.3 Plant Status System

Synge explained the IUCN PECS (Plant Existence Categorisation Scheme), which had received preliminary discussion at TDWG 2 (Document 11, PECS—Final Draft, July 1987). There had been considerable discussions with Kew, ILDIS and others as a result of which an amended version had been circulated (Document 12, Alternative Scheme based on July 1987 Draft) and was now presented for adoption as a TDWG Standard.

The key element of PECS was that aspects of plant occurrence were now separated into different descriptors, each of which could be scored independently: presence, native, introduced, cultivation, nature of cultivation, endemic, and degree of threat. Projects might adopt all of these, or select from them. The PECS status could be applied to any area, and for instance could be applied to whatever BRUs, ISO Countries and botanical countries were enumerated in the TDWG Geographical Standard. The revised PECS allowed for uncertain data, and distinguished doubt about the existence of a plant in an area from doubt about its status in that area.

Greuter expressed worries about the word “native”: it was essential to specify “autochthonous” and not just “wild.” Cullen was critical of the descriptor-states for the cultivation descriptor and urged further consultation. Bisby asked that the word “introduced” be carefully defined as its present use differed between flora writers and conservationists. Heywood suggested possible inclusion of a time element. Synge accepted that some final discussion of terms was needed, and that consultation with SCOPE would also be important.

Agreed: IUCN will re-draft PECS by the beginning of 1988 and circulate the new version to TDWG members for postal ratification in spring 1988.

1.4 Exchange Formats

There was discussion as to the most suitable name for data formats adopted by TDWG as standards for data transfer. ITF (International Transfer Format) was preferred over IXF (International Exchange Format) or XDF (Exchange Data Format). Heywood thought that it was better for non English-speaking users, and Kiger felt that “transfer” was more appropriate than “exchange” because the movement might often be one way only. A complication however was that the first ITF, that for botanic gardens plant records proposed by IUCN, went much further than a data format for data transfer: it attempted both to fix the actual fields used and to be a possible data structure for use within botanic gardens systems as well as for data transfer between them. This creates the potential for confusion, as future formats should, it was felt, not contain these other elements.

1.5 ITF for Botanical Garden Plant Records

Synge presented the final draft of the International Transfer Format for Botanic Garden Plant Records (Document 13) for adoption as a TDWG standard. This ITF had been
discussed at the previous meeting, and the draft circulated to members prior to this meeting.

There was adverse criticism both of the form and the intent of the ITF. Pankhurst thought it old-fashioned and restrictive to use a fixed-field format, but Mackinder defended it on the grounds that it was intended for use in a community that included many small institutions without computer expertise, in distant parts of the world. Allkin argued that the proposed system was far more than just a transfer format: it was a fairly specialised package no doubt widely discussed amongst botanic gardens, to agree the set of descriptors, and to provide a flat-file structure that could easily be set up at any garden. One could question whether such a specialised product would really benefit TDWG members in general. Further debate concerned the compatibility of the botanic gardens plant records ITF with other plant accession data, such as for herbaria, seed banks and germplasm collections. The plan to truncate data for values that exceed the fixed-length fields was criticised. Hawksworth reported that a more sophisticated system was in use in the microbial strain database network: they had spent much time defining fields, suitable acronyms and codes, but not worrying about field lengths.

Greuter questioned the descriptors included. There were no descriptors to cover the form of the accession (e.g. seed, tissue, graft etc.) or the presence of a voucher. He noted that all the descriptors were accession-based excepting the IUCN conservation status, which is taxon-based. McNeill thought the establishment of this standard would perpetuate the isolation of botanic gardens from the rest of the botanical community.

Walter reported that the format was already being adopted for use in files exported from the botanic garden plant record software that he was distributing. Heywood and Synge argued that the format be adopted now—a very considerable amount of consultation had gone into its production: it was ready for use and needed now.

Agreed: to adopt the ITF for Botanic Garden Plant Records for immediate use on the understanding that the format would be reviewed at a later date as regards compatibility both with other TDWG standards and with other accession-based records.

1.6 ILDIS Checklist Exchange Data Format

Allkin introduced the Exchange Data Format being developed initially for use within the ILDIS Project for exchanging taxon-based data between sites. It had not proved possible to circulate the details so this was being raised for preliminary discussion now. Whilst the present system was being used just within ILDIS, it might be of interest to TDWG to develop such a format as a standard for use between projects.

The ILDIS XDF (Document 14) system allows not only free format, but considerable flexibility in the actual format used and the descriptors included: this is achieved by an initial declaration specifying the format descriptors and structure. In a sense it is a data transfer language that could be extended to a range of taxonomic data sets. The advantage of a self-defining, generalised ITF is that each database would require just one piece of software to read in and out of it, and that it might be used for a wide range of data sets.

Kiger approved of the concept of a general taxon-based or checklist ITF, but stressed that we should not preempt the choice of descriptors. There was also the worry that, if taken piecemeal, various TDWG standards would not be compatible in themselves.

Hawksworth reported that microbiologists had already standardised their data and data definitions (see Gams et al., 1988, J. Gen. Microbiol., Vol. 134, in press—Ed.).

Russell argued that any generalised data-
transfer format should be preceded by a data dictionary—a thesaurus of data definitions to support all botanical databases and related computer applications.

Agreed: to ask Russell to proceed with production of a data dictionary, and to convene a subgroup to advise him on its style and content. (Subgroup to consist of Ellen Farr, Didelot, Sutton, Hawksworth, Kiger, Magill, Allkin, Rooney, and Russell, convenor.)

Agreed: to ask Allkin to circulate details of the ILDIS Checklist XDF and to conduct extensive consultations with a TDWG subgroup, prior to bringing forward a general-purpose checklist/taxon-based ITF. (Subgroup to consist of Mackinder, Pankhurst, Zellweger, Kiger, Winfield, Magill, Rooney, Ellen Farr, Walter, and Allkin, convenor.)

1.7 Minimum Species Checklist Module

Bisby introduced the minimum species checklist module, an attempt at defining the minimum content of a species checklist for use in taxon-based databases in botany (Document 15). A subgroup had met the previous evening (Allkin, Coode, Syngne, [Russell, absent], Greuter, McNeill, Zellweger, Magill, and Bisby, convenor) and had found the document broadly acceptable. Several areas that had not been resolved concerned the degree of nomenclatural detail required. There was doubt as to whether non-systematic databases could realistically be expected to include:

i) adequate treatment of relationships between species, subspecies and varieties;
ii) name elements to cover hybrids
   —binomials with “x”
   —quadrinomials with “x” in the middle
   —the linkage of synonyms of the parental combinations;
iii) synonymy classes
   —inclusion of misapplied names and orthographic variants
   —question of whether synonyms should be ranked, possibly into those of acceptable alternative names, homotypic synonyms, doubtful synonyms, etc.;
iv) citation of references
   —the original publication of the name, or a modern reference using the name
   —for misapplied names, either a) a reference to the recognition of the misapplication or b) a list of publications where the name is misapplied.

Allkin suggested it be clarified as to whether the TDWG standard would define just the minimum set of fields, or also include their logical structure, or even their format. It was agreed that the standard would define fields, and the botanical rules that link them; it would not define database structure or format. There was continued uncertainty about a suitable name for this standard and some support for the name “minimum function nomenclator” used at TDWG 2.

Agreed: that Bisby should circulate an updated version to the subgroup for further comment, and then put it to the next TDWG meeting for adoption.

2.1 Name-Author Abbreviation System

Brummitt reported that a broadly based international project is now under way. He had consulted with a wide panel of correspondents and this had led to the adoption of a list of principles, the most important of which is that TL-2 abbreviations are adopted automatically. He was working on a computer file at Kew for name-authors of seed plants, and work on other groups was progressing as follows:

- Pteridophytes — Paris at K
- Bryophytes — Crosby at MO
- Fungi & Lichens — Kirk at CAB
  Int. Myc. Inst.
- Algae—freshwater/diatoms — BM
  — marine — Silva
- Fossils — Clifford at BRI
Brummitt hoped that if the system was successful, it might be possible to provide it with some international status or to propose its adoption for the Code at the next Congress.

Bisby asked whether there had been any trial of how to disseminate the system, especially given the request (TDWG 1) that it be made available in machine-readable form. Mackinder suggested that the transfer data format might be used to disseminate it. In response to a question concerning other author information, Kiger expected that the Hunt Institute will have made progress with its database on the biography of botanists by next year's TDWG meeting.

Agreed: that Brummitt be asked to circulate the name-author principles in time for adoption at the next TDWG meeting.

2.2 Periodical Titles

Kiger reported that the Hunt Institute was not quite ready to circulate the BPH-2 draft supplement. Every title is mentioned in the new volume (BPH-2), however full details are given only for new or changed entries. BPH-2 has a unique sequence number for all journals, somewhat analogous to the numbers of books in TL-2. BPH-1 is still available for sale. BPH-2 will be available on tape soon after the book is printed.

Burdet announced that the Conservatoire et Jardin botaniques in Geneva was printing a supplement to the catalogue of its library holdings.

2.3 Book Titles

Crosby reported that it was now possible to obtain abbreviated book titles from the TROPICOS system at MO, but there is no index to the abbreviations. TL-2 abbreviations are used, but there are problems: TL-2 coverage was never meant to be complete, the cut-off date is unclear, and individual word abbreviations are not consistent through all volumes.

12,000–15,000 titles are involved. Abbreviations have been invented for about 25% of them, and new ones are added as MO searches nomenclatural databases.

Brummitt suggested that only books that contain at least one new name need be considered.

2.4 Family Names

Crosby announced that MO now has a file of c4,000 family names with entries for family name, higher taxon, source plus some synonymy, etc. from Willis.

Kiger reported that the Hunt Institute planned to publish a catalogue of vascular-plant family names (Reveal, Bedell and Kiger) in electronic form. It would be primarily a nomenclatural index consisting of validly published names and citations without judgements on current usage and therefore not taxon-based. There would be orthographic variants and synonyms. But it would relate to taxon-based systems in that there would be concordances between position in the classifications of Engler & Prantl, Cronquist, Thorne, and Dahlgren. Mnemonic codes form part of a hierarchical coding system.

Hawksworth reminded the meeting that a list of family names for fungi had been published in 1970. This was now being revised and fossil fungi are being added for publication during 1988.

Agreed: that Crosby be asked to liaise with Kiger to ensure coordination in production of the lists.

2.5 Generic Names

Ellen Farr reported that ING contains about 61,000 generic names, of which subsets can be made available to individual projects in machine-readable form. Each entry assumes a single taxonomic placement and some entries have data on typification.
2.6 Index Kewensis and the Kew Index

Coode described the new Kew Index. Input is computerised and from now on the timing of publication will be as with the volume for 1986—all names noted in a calendar year will be published the following June. Content is similar to Index Kewensis, except that it includes ferns and fern allies. Names from annual volumes of Kew Index will (as before) be published in the accumulated 5-year supplements of Index Kewensis (phanerogams) and in Index Filicum (ferns and fern allies).

Now that current production of KI and IK is back on schedule (Supplements 17 and 18 were published in June 1987), Kew has taken on extra staff to deal with loading the backlog of IK from tapes produced by optical scanning into the IK database. Supplements 4–12, 18, and 1986 are already loaded into the database. Supplement 3 is in progress; No. 2 is being started and No. 1 is being planned. Afterwards the initial volumes will be addressed. 1990 is the target date for its completion as a database operating under the STATUS system.

The IK database will be capable of being searched on fields and sub-strings, but it will still just be a representation of the content on the originally printed pages, and not consolidated between volumes or families. When completed Kew will have various options which will depend on funding and on demand:

1) leave the database as it is;
2) correct errors (e.g. departures from the original printed page) as notified;
3) correct errors and consolidate completely;
4) correct errors, consolidate completely, and upgrade with taxonomic judgement on the status of each name.

Coode confirmed that it would be possible to search by name-author (and using an equivalence list of abbreviations), in response to a query by Morin. McNeill thought option 3), a consolidated database of place of publication of all names listed was what is needed. Coode asked participants to let him know what would be the commonest enquiries. The following were suggested:

1) every name in a genus;
2) every name in a family;
3) check details for a given name (usually binomial, often without name-author);
4) all names for a certain large geographical area;
5) all names with a certain name-author.

Loader outlined possibilities for providing access to the IK database. One was to provide online access either by installing a PSS node at Kew or by placing the database with one of the database organisations such as CABI. Others were to distribute all or part of IK on CD-ROM or magnetic tape with the software necessary to gain access.

The IK database runs under the STATUS system which provides regular text retrieval that can be constrained to particular text fields or chapters in the database. There is also a report generation facility. The database entry for new names serves both production of the printed books (KI and IK) and entry to the IK database. Kew would welcome assistance in “cleaning-up” parts of the IK database—checking and correcting the few remaining errors to ensure that entries match the original publication.

Crosby thought that Missouri Botanical Garden would welcome tapes or a CD-ROM containing all IK names for use in the TROPICOS system. Schrire asked Kew not to overlook the demand for access from botanists in the Third World. Allkin pointed out that online use of the present database would involve considerable familiarisation: there would be an overhead in training users. McNeill thought it would be useful for experts to assist in correcting the IK database entries provided it was limited to typographic errors from the optical scanning and did not include any sort-
ing out of nomenclaturally inappropriate entries etc.

2.7 TROPICOS

Magill circulated copies of a booklet describing the structure and workings of the TROPICOS system at Missouri Botanical Garden (Document 16). The system provides online entry by name to screens of nomenclatural data (name, name-author, publication, type, type location) with other data on synonymy, publications, and some taxon-based data on family membership, geographical distribution etc. Magill is now involved in downloading parts of the system for use on PCs. Providing such downloads takes time and labour. A further problem is how might users contribute data to the system. At present the facilities are read-only.

In response to a question by Kiger, Morin explained that a free telephone line (800-dialling) was presently being tested with FNA editors. Crosby pointed out that this was without charging either for database access or the telephone: somebody has to pay these costs and yet many of the users could not afford to pay.

Brummitt asked whether TROPICOS made any value judgment about the integrity or correctness of the nomenclature reported, to which the answer was no, data is tied in its original form to its original publication.

2.8 Index of Fungi

Kirk described the Index of Fungi, which has been issued at 6-month intervals since 1940. Since 1980 it has been produced both as a publication and as a database operated by CABI. It covers both the nomenclature and the literature for all ranks from family down to form. (It would thus be the equivalent of IK and Kew Record combined if it covered phanerogams.) The pre-1980 backlog has not been entered but keyboarding for this will start in 1988.

Heywood and others expressed interest in seeing more of this system. It appeared to be ahead of the other nomenclatural indexes in terms of services and consequently may yield valuable lessons for the others.

Agreed: to ask CABI to circulate samples for the next TDWG meeting.

2.9 Registration of Names

Greuter reported that proposals concerning possible registration of names had had a mixed reception at the Botanical Congress in Berlin. Two sub-committees had been established to give further consideration to registration. The original emphasis had been to promote registration of new names in the future, and the assumption that registration was a preliminary to producing “approved lists” of names. At Berlin the emphasis had shifted from registration to lists of approved names, or of names in current use. The latter would contain all the names in current use, including those drawn from alternative taxonomies of the same plants. If they could then be “conserved” the effect would be to prevent any of them being overturned by subsequent discoveries of earlier names—a major step towards stability.

IUBS has agreed to sponsor a small meeting in spring 1988. This is to be held at CAB International Mycological Institute, Kew to define standards for lists of names in current use. There was a possibility of starting such lists for generic names (perhaps based on ING), and of starting pilot projects for species lists in certain groups that are already being worked fairly intensively—possibly legumes, smuts and rusts, or mosses.

Brummitt expressed approval of how these ideas had evolved since the meetings in Berlin. Crosby asked whether there were yet any estimates of what percentage of names are in current use—hearsay puts the figures at about
one-fifth from *Index Kewensis* for species names, and slightly higher for genera from ING. The other figure often quoted was that for Angiosperms there are a quarter of a million species, but a million names. Hawksworth estimated that for the Fungi two-thirds of the generic names could be abandoned.

*Agreed*: the meeting expressed strong interest in these activities and wished to encourage IUBS and IAPT in assisting the work that would be needed to bring about the necessary change.

### 2.10 Linnean Society/BMNH Linnean Typification Database

Sutton explained that the Linnean Society and the British Museum (Natural History) had been working since 1980 on a joint project to provide a catalogue of the Linnean names for plants and their lectotypification details (see Document 17, The Linnean Plant Name Typification Project). Lectotypifications are needed because although Linnaeus did cite illustrations and specimens, he did not use the present type system as such. There are about 9,000 names with the appropriate specimens and illustrations concentrated at the Linnean Society and at the BMNH in London, and in several centres in Sweden. The project should be completed in 1990.

Data are now being entered to a fully relational database in which names are linked to: currently accepted name, all type elements and their locations, geographical data from the protologue, details of all known lectotypifications, and judgements on their acceptability. The project will produce a hardcopy type catalogue. There will be the possibility of local access to databases at the BMNH and at the Linnean Society and copies of the database might be distributed to other institutions. In the longer term, there might be some unification with other typification databases within the BMNH or with related projects at other institutions.

#### 2.11 Index of Algae

Duncan reported that work continued in updating the card index of 150,000 names of Algae. The computerisation project has yet to be finalised.

#### 2.12 Nomenclatural Indexing Subgroup

Duncan reported that the Nomenclatural Indexing Subgroup had met and agreed to go ahead with four themes:

1. description of the data structure in nomenclatural index systems;
2. coordination and methods of achieving this (e.g. software, transfer etc.);
3. making the indexes available electronically;
4. type registers and whether they should be linked with nomenclatural indexes.

The meeting was enthusiastic and a report by the Subgroup was promised for the next TDWG meeting.

Ellen Farr stressed the importance of being able to transfer nomenclatural index information from institution to institution. It is important the transfer format be capable of handling this. Russell commented on the tremendous interest in a single type register despite the vast amount of work involved. The Smithsonian Type Register had been started by Hale and Shetler. Hawksworth stressed that the ultimate usage of lectotypification and type registers was in relation to current taxa: it was therefore important that in all cases attempts be made to link types to accepted names of taxa in current use.

*Agreed*: to establish a further subgroup to report back on type and lectotypification registers. (Subgroup to consist of Ellen Farr, convener, Russell, Sutton, Cullen, Cannon, Morin and a representative from K.)
Kiger asked whether there had been any progress with collaboration between IK and the *Gray Index*. Coode responded that correspondence had been entered into.

**Taxon-Oriented Systems**

2.13 DELTA Exchange Format for Descriptions

Allkin introduced, on behalf of Gibbs Russell and himself, the proposal that Dallwitz’s DELTA format be adopted as a TDWG standard for the exchange of plant descriptions (see Document 18, Proposal for Adoption of DELTA Data Format). It is already a standard in the sense that it is widely used and indeed the only format widely used. However different versions had appeared and there is a need to agree at TDWG that just one of these be the standard. Dallwitz had agreed to maintain the standard for TDWG and to continue providing the User’s Guide.

The proposal was welcomed by many of those present. There was discussion as to whether it should be adopted now, or, like the other standards proposals, be treated as a preliminary proposal now and brought forward for final adoption at the next TDWG meeting after the circulation of details to TDWG members. Given the need to circulate documentation it was agreed to bring this forward for final adoption at the next meeting.

2.14 SEPASAL Plant Uses System

Rooney introduced the Plant Uses System being developed at the Kew SEPASAL project. SEPASAL is building up a large database covering the economic uses of plants. It includes data on the value and economic uses of plants in medicine, in agriculture and as chemical sources.

SEPASAL uses a 5 level hierarchy with a limit of 9 classes at each level (Document 19). This, though not ideal, is very workable. Some 30–40% of the uses vocabulary has been standardised with the vocabulary used in CABI’s bibliographic databases. It is an open system to which additions can be, and are, occasionally made. Because the SEPASAL database is currently undergoing restructuring, there will be some changes followed by at least a “stable plateau.”

There was considerable interest expressed in the SEPASAL system. Magill enquired how long it would be before the stable plateau was reached and whether the upper levels were fixed yet. Rooney replied that the restructured system might be in use in 9 months time. The upper levels have not and will not be fixed—it is an open system to which additions will be made. Other projects are welcome to use the SEPASAL system, but it is not being proposed as a standard and it will certainly change in the future. SEPASAL would welcome comments on the system.

Syngé commented that Prof. Hawkes had produced a plant-usefulness evaluation system for IUCN. It incorporated a simple categorisation in 10 major sectors of uses.

2.14 SEPASAL/ILDIS Plant Ecology System

Lock reported on preliminary work undertaken jointly for SEPASAL and ILDIS, to explore the possibilities of establishing a simple high level system that described the ecological characteristics of plant species. An outline system (Document 20) has three components:

1) bioclimatic zone—such as those from the Walter et al. system;
2) site descriptors—particular habitats/sites within the bioclimatic zone;
3) vegetation type—strictly physiognomic.

Kiger suggested that use might be made of the dictionary of environmental factors published by Walter Lewis. Heywood said that related work was being undertaken at IUCN.
Considerable interest was expressed in the Plant Ecology System and it was agreed that Lock be asked to coordinate the work in consultation with FNA and IUCN.

2.15 Developments at BIOSIS

Dadd reported briefly on the experimental Vicieae Database Online at BIOSIS that had been tested for one month in August. A demonstration would be given at the end of the session.

2.16 Dictionary of Fungi

Hawksworth reported that the CABI Dictionary of Fungi has been available online for some time. It gives details of accepted species names and synonymy.

Hawksworth also mentioned that the CABI bibliographic database contains a thesaurus that gives names and synonymy for cultivated plants, and that MINE, the network for culture collections in Europe, will be available shortly.

2.17 Survey of Taxonomic Databases

Kiger reported that it was still the intention of the Hunt Institute to establish a survey of taxonomic databases that would list active, multi-person database enterprises. Crosby asked that it include also dead databases, some of which were potentially important. Stirton would hand on to the Hunt Institute the results of a survey he had conducted. Kiger circulated a preliminary list of categories of information to be sought (Document 21, Worldwide Survey of Taxonomic Databases).

3.1 “Designs for a Global Plant Information System”

Bisby reported on discussions amongst the subgroup organising the International Symposium “Designs for a Global Plant Information System.”

The plan is to organise a major international conference to examine the very many possible “designs” for a global plant information system. These “designs” would be examined at a number of different levels, such as data structure, data entry and validation, database software, nomenclatural and taxonomic decision making, organisation of nomenclatural and taxonomic expertise, communications amongst participants, dissemination to users, ownership, copyright, institutional roles, funding, services and demand. The intention would not be to design a single system but to see the widest possible range of options.

The initial plan for Duncan to organise funding for the conference to be held in California in July 1988 had fallen through and there was now a need for fresh proposals for venue and funding. Duncan thought that TDWG would need greater visibility and credibility in the USA for US funding to be obtained, especially as various other “computers in systematics” initiatives were now under way.

Heywood thought the conference was of major significance. It needed to be well-organised and funded, with the majority of papers carefully pre-prepared. Greuter thought it was an appealing idea, albeit also attended by dangers. Time was needed to organise it well. Could a satellite meeting at the next ICSEB meeting in 1990 at the University of Maryland be suitable?

Stirton expressed concern about conferences with invited papers only—the conference should include open paper sessions too. Lock queried the focus on plants—even if it was plant dominated, would there not be value in contacting other biologists?

Agreed: that Duncan and Morin explore possibilities in the US, and Bisby and Heywood explore possibilities in Europe. One or more planning meetings would be needed, as early
as possible in 1988, in addition to funds and a location for the main conference.

3.2 Publication of Standards, Proposals and Reports

Agreed: to accept the Hunt Institute’s kind offer to publish the Report of the meeting in Huntia, and to start a new series of publications “Taxonomic Database Working Group Standards.”

Agreed: to invite Burdet, Zellweger and von Arx to take on the task of editing a TDWG Newsletter.

3.3 TDWG Electronic Mail Network

Dadd reported that a telecom gold user network had been established in March 1987 by BIOSIS for the dual purposes of TDWG member organisations and the centres participating in the ILDIS project. A central group subscription had been underwritten by BIOSIS and BIOSIS was providing both a system manager and individual billing for the usage charges. Usage had started slowly but was now picking up amongst the ILDIS participants. It was now available for all TDWG members.

Heywood expressed the Group’s appreciation, and encouraged members to go ahead and use the system now.

3.4 Status and Affiliation to IUBS and IAPT

Bisby had been in touch with the IUBS secretariat and it now appeared that there would be some advantage in affiliating as a commission of IUBS. Affiliation would give TDWG some international standing, allow it to report back to IUBS and CODATA, and make it possible to seek some small funds. In view of this Bisby had, after consultation with the Convenor, submitted a preliminary application to the IUBS Executive Committee

which had met just a few days earlier. IUBS had indicated that the application was welcomed. It would require a more formal statement of constitution, election of officers, statements of funds, and openness of membership than at present, but these could be presented and adopted at the next TDWG meeting in time for formal presentation to the IUBS General Assembly in October 1988. In all probability IUBS would refer to TDWG by some other name such as the IUBS Commission for Plant Taxonomic Databases.

Greuter expressed the view that there would also be advantage in affiliating to IAPT, given the obvious nomenclatural and taxonomic significance of the activities being discussed and developed.

Agreed: the officers to go ahead with preparations for affiliation to IUBS, and to explore the possibility and consequences of affiliating to IAPT.

3.5 Membership and Constitution

Several of the US participants asked for clarification of who were the actual members of TDWG, and whether it could not be opened to a wider range of potential contributors. Heywood explained that the original intention had indeed been to keep the Group small enough for representatives to work informally at round-table meetings. The members were either projects working on taxonomic databases of international significance (e.g. IUCN, ESFDS, ILDIS) or the major botanical institutions producing or with interests in such databases (e.g. MO, Kew, Geneva). In addition representatives of IUBS, IAPT and CODATA had been invited. Efforts at drawing in Asian, African and South American participants had not so far been successful, but it was thought that there would be Australian representation at the next meeting.

Agreed: that the next meeting be more widely advertised, and that a wider range of projects,
institutions and individuals be invited to participate. The result would be a larger meeting, but it was anyway envisaged that the next meeting would be split at times into parallel sessions organised by the different subgroups.

There was also discussion about the rising burden of mailing and organising the copying and circulation of papers needed if TDWG and its subgroups was to function more efficiently.

Agreed: that an annual membership fee be introduced, probably in the range from $100 to £100 per institution/project.

It was also clear that if there was to be a larger attendance the host institution could hardly be expected to cover even larger costs.

Agreed: that the host institution be entitled to make a charge as needed, to contribute to the costs of running future meetings.

3.7 Election of Officers

The following were elected:
Convenor & Chairman — Heywood
Vice-Chairman (host of the next meeting) — Crosby
Rapporteur — Bisby
US Office — Kiger
Newsletter editors — Burdet, Zellweger & von Arx

3.8 Adjournment

The chairman thanked Cullen and his colleagues for the splendid job they had done on organising such a useful meeting accompanied by such warm hospitality — there was much applause. He also expressed everyone's great gratitude to the sponsors—RBG Edinburgh, BIOSIS, CABI, and IUCN—whose generosity had provided funds for the meeting.

___

TDWG Secretariat
Biology Department, Building 44
University of Southampton
Southampton SO9 5NH, UK [FAB]

Department of Botany
British Museum (Natural History)
Cromwell Road
London SW7 5BD, UK [DAS]

and

Department of Botany
NHB 166
Smithsonian Institution
Washington DC 20560, USA [GFR]
# Appendix 1
## Attendance

<table>
<thead>
<tr>
<th>Member Institutions &amp; Projects</th>
<th>Representatives</th>
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<tbody>
<tr>
<td>Botanischer Garten und Botanische Museum, Berlin (also IAPT)</td>
<td>W. Greuter</td>
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<tr>
<td>BIOSIS, Philadelphia &amp; York</td>
<td>M. N. Dadd</td>
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<tr>
<td>British Museum (Natural History), London</td>
<td>G. Mackenzie</td>
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<tr>
<td>Conservatoire et Jardin botaniques, Geneva</td>
<td>D. A. Sutton</td>
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<td></td>
<td>R. J. Pankhurst</td>
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<td></td>
<td>H. M. Burdet</td>
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<td></td>
<td>C. Zellweger</td>
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<td></td>
<td>A. Didelot</td>
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<td></td>
<td>D. L. Hawksworth</td>
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<td></td>
<td>P. Kirk, P. Cannon</td>
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<tr>
<td>CAB International Mycological Institute, Kew</td>
<td>R. W. Kiger</td>
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<tr>
<td>Hunt Institute for Botanical Documentation, Pittsburgh</td>
<td>J. McNeill</td>
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<tr>
<td>IUBS &amp; IAPT</td>
<td>V. H. Heywood (Convenor, in the chair)</td>
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<tr>
<td>IUCN (Conservation Monitoring Centre) Kew</td>
<td>H. Synge, D. C. Mackinder</td>
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<td></td>
<td>F. A. Bisby (Rapporteur)</td>
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<td></td>
<td>R. Allkin, S. Hollis, M. J. Lock, P. J. Winfield</td>
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<td></td>
<td>M. R. Crosby, N. Morin</td>
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<td>R. E. Magill</td>
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<td>B. Thiens</td>
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<td>B. Schrire</td>
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<td>J. Cullen (Host)</td>
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<tr>
<td>New York Botanical Garden, Bronx</td>
<td>E. R. Farr, G. F. Russell</td>
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<td>PRECIS, Pretoria</td>
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<td>Royal Botanic Gardens Edinburgh</td>
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<td>Royal Botanic Gardens, Kew</td>
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<td>Smithsonian Institution, Washington</td>
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### Observers

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<th>Observers</th>
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<tr>
<td>Flora Veracruz, Jalapa &amp; Riverside</td>
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<td>Center for Plant Conservation, Arnold Arboretum</td>
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<td>Reseau Suisse Floristique, Geneva</td>
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<td>Royal Botanic Gardens, Kew</td>
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<td>T. Duncan</td>
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<tr>
<td>K. S. Walter</td>
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<tr>
<td>J.-M. Mascherpa</td>
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<tr>
<td>B. von Arx</td>
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<tr>
<td>C. H. Stirton</td>
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<td>S. Henchie</td>
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### Apologies for Absence

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<tr>
<td>Botanical Survey of India, New Delhi</td>
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<tr>
<td>Gray Herbarium, Harvard</td>
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<td>MAB II/UNESCO, Washington</td>
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<td>Flora of Ecuador, Aarhus</td>
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<td>Bureau of Flora and Fauna, Canberra</td>
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<td>CSIRO, Canberra</td>
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<td>USDA, Beltsville</td>
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<td>US Nature Conservancy</td>
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<td>(M. P. Nayar)</td>
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<td>(E. A. Shaw)</td>
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<td>(P. Frost-Olsen)</td>
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<td>(P. Bridgewater)</td>
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<td>(L. Watson)</td>
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<td>(D. Farr)</td>
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<td>(L. E. Morse)</td>
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Appendix 2
Papers Presented

Papers marked * were circulated beforehand so that member institutions and projects could form a considered opinion.

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Project/Inst.</th>
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<tbody>
<tr>
<td>*1 Draft Geographical Classification</td>
<td>Mackinder</td>
<td>IUCN</td>
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<tr>
<td>*2 ILDIS Geographical System (Version 1)</td>
<td>Hollis</td>
<td>ILDIS</td>
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<tr>
<td>3 Examples of dividing ISO Countries following rules of ILDIS</td>
<td>Hollis</td>
<td>ILDIS</td>
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<tr>
<td>4 Aid to discussion on Geographical Systems</td>
<td>Bisy</td>
<td>ILDIS</td>
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<td>5 A Proposed World Geographical System</td>
<td>Brummitt</td>
<td>Kew</td>
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<td>6 List 1 (Taxonomic Botanists’ Countries)</td>
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<td>Kew</td>
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<td>7 List 2 (Botanical Recording Units listed with TBC membership)</td>
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<td>Kew</td>
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<tr>
<td>8 List 3 (Combined TBC, BRU, ISO Country Gazetteer)</td>
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<td>Kew</td>
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<tr>
<td>9 List 4 (BRUs with TBC membership)</td>
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<tr>
<td>10 List 5 (Proposed Continental and Subcontinental System)</td>
<td>Brummitt</td>
<td>Kew</td>
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</table>

Plant Status

| *11 Plant Existence Categorisation Scheme (PECS) Final Draft, July 1987 | (Synge)         | IUCN          |
| *12 PECS—Alternative Scheme based on July 1987 draft                  | (TPU)           | IUCN          |

Exchange Formats & Other Standards

| *13 International Transfer Format (ITF) for Botanic Garden Plant Records | (BGCS)          | IUCN          |
| 14 Exchange Data Format (XDF)—ILDIS Subset Proposal, 2nd Draft         | Allkin, White & Winfield | ILDIS          |
| *15 Minimum species checklist module: preliminary proposal             | Bisy, White & Allkin | ILDIS         |
| 16 TROPICOS: A Botanical Database System at the Missouri Botanical Garden | Crosby & Magill | MO            |
| 17 The Linnean Plant Name Typification Project                          | Sutton & Jarvis | BMNH          |
| 18 Proposal for adoption of DELTA data format                          | Allkin & Gibbs  | Kew & PRE     |
| 19 SEPASAL Uses Codes System                                           | Rooney          | SEPASAL (Kew) |
| 20 SEPASAL/ILDIS Environmental Factors                                 | Lock            | SEPASAL & ILDIS |
Appendix 3
TDWG Subgroups

Geography Standard (established TDWG 3 minute 1.2)

Data Dictionary (established TDWG 3 minute 1.6)
Russell (convenor), Ellen Farr, Didelot, Sutton, Hawksworth, Kiger, Magill, Allkin, Rooney.

ITF (established TDWG 3 minute 1.6)

Minimum species checklist module (established TDWG 2 minute 4.2)
Bisby (convenor), Allkin, Coode, Synge, Russell, Greuter, McNeill, Zellweger, Magill.

Book titles (established TDWG 2 minute 1.3, but did not report at TDWG 3)
Crosby (convenor), representatives from G and NY.

Nomenclatural Indexing (established TDWG 2 minute 3.4)
Duncan (convenor) Ind. Nom. Alg.; representatives from K (IK), Harvard (Gray), MO (Ind. Musc.), CABI (Ind. Fungi), Field Museum (Ind. Hepaticae), G.

Type and Lectotypification Registers (established TDWG 3 minute 2.12)
Ellen Farr (convenor), Cullen, Russell, Cannon, Morin, Sutton and a representative from Kew.

Conference Organising Committee (established TDWG 2 minute 4.6)
Bisby (convenor), Duncan, Heywood, Morin, Synge, Kiger.