THE ROYAL SOCIETY

Published online 24 March 2004

Towards a working list of all known plant species

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A complete listing of the world's known plant species has long been considered desirable but has remained an elusive target for generations of botanists. The adoption of the Global Strategy for Plant Conservation has reinforced the urgent need for a global plant checklist to support, facilitate and monitor the conservation and sustainable use of plant diversity worldwide. The increasing availability of large databases of biological information over the Internet has demonstrated that many of the obstacles to the collation and dissemination of vast, shared datasets can be overcome. We examine the challenges that still remain to be addressed if the botanical community is to achieve its ambitious objective of delivering a working list of all known plant species by 2010.

Keywords: checklist; plants; names; nomenclator; index; synonymy

1. INTRODUCTION

(a) *Global Strategy for Plant Conservation*

In April 2002 the Sixth Conference of the Parties to the Convention on Biological Diversity made a groundbreaking decision to adopt and endorse the GSPC (decision vi/9). At the core of this strategy is a series of specific but ambitious objectives to be delivered by 2010. The first of these targets is the production of

> A widely accessible list of known plant species, as a step towards a complete world flora.

In the months that followed the adoption of the GSPC I have had cause to discuss Target 1 with a wide variety of individuals and groups, ranging from plant systematists through practising conservationists to members of the general public. In so doing, I have repeatedly been struck by the uniformity of the response to the target by members of each of these groups. Plant systematists have tended to welcome the recognition that an understanding of plant diversity at the species level is fundamental to any effort to conserve species or ecosystems (Mace 2004). Almost invariably, they then went on to dwell on the enormity of the task of producing a comprehensive list of known plant species and the need for significant international funding if such a goal were to be achieved by 2010. Conservationists have generally welcomed Target 1 as a restatement of a need to which they had already been drawing attention for many years; often in tones conveying some irritation that such an apparently simple request had not yet been met. Among the general public, the most common reaction has been one of surprise that such a list does not already exist. This review explores some of the historical and practical reasons underlying the lack of a comprehensive world list.

One contribution of 19 to a Theme Issue 'Taxonomy for the twenty-first century'.

(b) *Index Kewensis*

One of Charles Darwin's last projects was to fund the preparation of a list of plant names, which in the century that followed became known to botanists all over the world as the Index Kewensis. Index Kewensis records each plant name with its author(s), place of publication and approximate geographical origin. It has long been an indispensable reference work for botanists preparing detailed studies of particular groups of plants (monographs) or inventories with descriptions of all the plants of a particular area (floras) or, in fact, anyone dealing with plant names.

2. THE INTERNATIONAL PLANT NAMES INDEX

Some 106 years after it was first published, Index Kewensis reached a wider audience under the umbrella of the IPNI, an Internet accessible merger of Index Kewensis with the Gray Herbarium Index, compiled at the Harvard University Herbaria, and the Australian Plant Names Index, based at the Centre for Plant Biodiversity, Canberra. IPNI, launched in December 1999, now handles over 18 000 queries per day. However, e-mail enquiries to the IPNI editors and comments from the general public make clear that a significant proportion of users expect and/or would prefer a different product to that which IPNI represents. Indeed, even Darwin might consider that the outcome of his bequest is not quite what he had envisaged.

(a) *Index Kewensis: an index or a nomenclator?*

What Darwin wanted, and what Sir Joseph Hooker undertook to direct and supervise at Kew, was 'the compilation of an Index to the Names and Authorities of all known flowering plants and their countries' (Hooker 1893). Darwin's desire for such a list was driven by the difficulties he had experienced in 'accurately designating' or naming the plants he had studied. Thus, implicit in Darwin's request was the requirement for the list to indicate which was the correct name for a particular taxon and which other names (synonyms) also referred to that taxon

but were not to be used. In today's terms, what was envisaged was a list of accepted names and their synonyms—and this is what was attempted in the early volumes of Index Kewensis. It has been suggested that at that point the work should not really have been called an index since an index should cite names, references, dates (and perhaps distributions) without passing any taxonomic judgements (Meikle 1971). A nomenclator goes further; it not only cites names but tells us which names are to be accepted and which rejected, and what is to be regarded as the correct name of any particular taxon. The International Code of Botanical Nomenclature (Botanical Code) (Greuter *et al.* 2000) does not define the term, accepted name, but it does use the concept of acceptance (e.g. Article 34.1) and I use acceptance in the same sense here. An accepted name is one that an author, or authors, consider to be the nomenclaturally correct name for a taxonomic entity which he/she/they recognize. Thus an accepted names list (or nomenclator) expresses taxonomic opinion as to which taxa are to be recognized as well as indicating which are the nomenclaturally correct names for taxa so circumscribed. Applying these definitions, in its early years, Index Kewensis was more a nomenclator than an index. However, the task of maintaining a world overview and acting as an arbiter of taxonomic opinion was soon acknowledged to be too ambitious for a single compiler and his assistants at Kew. Jackson (1887, p. 68) commented that 'The whole work is so vast that it is quite out of the question for me to give much time to synonymy'. Over time, the scope of the work was changed to that of a 'faithful index' of published names, a product no longer presenting a peculiarly Kew view but more acceptable to international opinion (Meikle 1971). Thus, from 1913 the Index Kewensis became a straightforward index, giving the names and references for validly published plant names, without passing taxonomic judgements and this continues to be its role up to the present day as a partner and key contributor to the IPNI. Some 90 years on, misconceptions as to the purpose and standing of Index Kewensis continue, and are regularly reflected in enquiries received by the editors of the IPNI.

One can hardly blame these enquirers for seeking what does not yet exist. Given that vascular plants are among the better known groups of organisms, it would seem perfectly reasonable to expect that both an index and an accepted names list (nomenclator) should be available. The fact that the latter is lacking, despite clearly articulated demand from a broad potential user community over many years, indicates that the preparation and maintenance of a list of accepted plant names is a more challenging and demanding task than first impressions might suggest. In fact, our experience suggests that any enterprise seeking to compile lists of accepted names faces all the difficulties inherent in any major biological indexing project plus further layers of complexity arising from the task of establishing and indicating which names are correct and which should be considered synonyms. I seek to describe these two classes of problem before discussing the approaches adopted by some other recent and current initiatives of a scope comparable to the Index Kewensis project.

3. PROBLEMS COMMON TO MANY (MOST?) NOMENCLATURAL INDEXES

(a) *Dispersed biological literature*

The dispersed nature of the biological literature is arguably the fundamental problem common to all nomenclatural indexing projects. Revisions and monographs are published in a wide variety of more or less scientific journals and non-serial publications. Individual nomenclatural novelties (new taxa, new combinations and *nomina nova*) may be even more scattered in their occurrence, appearing in ecological treatises and horticultural guides as well as in the mainstream taxonomic literature. Over time, amendments to the Botanical Code (Greuter *et al.* 2000) have eliminated some of the most ephemeral publications as vehicles for the effective publication of new plant names, with trade catalogues and non-scientific newspapers being ruled out in 1953 and seed exchange lists in 1973. However, there remain some 670 periodical titles in which botanical nomenclatural novelties are published with sufficient frequency to justify their inclusion in the ongoing literature survey conducted by the compilers of Index Kewensis. The survey, which also includes non-serial publications, yields some 6000 new entries to the Index Kewensis database each year. (The scattered nature of the primary literature is probably the fundamental 'raison d'être' of the nomenclatural index; if publication of names in particular groups were confined to just a few journals then each biologist or specialist group might undertake the compilation work necessary to obtain a master list for their particular group of interest.)

(b) *Funding*

Resource considerations face most compilers of nomenclatural lists at one stage or another in their development. Typically, the product is used a little by a large number of users and consulted more frequently by a much smaller number of users. Which, if any, of these users should pay the compilation costs? The option of a nominal charge per record accessed is often mentioned. However, even with a differential charging model, it must be remembered that a charge considered 'nominal' in the developed world may represent a considerable deterrent to use in developing countries. Furthermore, the bureaucracy associated with any sort of charging mechanism may deter a considerable number of potential users including those reluctant to engage in any sort of Internet transaction because of the risk of receiving 'spam' or of suffering credit card fraud. In an ideal world, resources such as nomenclatural indexes should be made available free at the point of use so that the effort invested in preparing them can benefit the greatest possible number of users. However, in the real world there is often a trade-off between maximizing access and safeguarding an actual or potential revenue stream to fund ongoing maintenance and additions to the database.

A further funding challenge likely to face the compiler of any significant nomenclatural index is the need to convert legacy data to digital form. The range of technologies available to undertake this task has expanded considerably since the mid-1980s when the Index Kewensis was converted to electronic form using optical character recognition, followed by three person-years of editing to remove the errors introduced during this operation. Despite technological advances, the unit cost of converting text to

searchable digital form remains high. Regrettably, although digitization projects are the key to making better use of existing information and ensuring that new information is gathered by the most productive means possible, such projects often have very limited appeal and can prove extremely difficult to 'sell' to funding agencies or potential sponsors.

4. PROBLEMS SPECIFIC TO ACCEPTED NAMES LISTS

(a) *Differing taxonomic opinion*

When botanists discuss the preparation of accepted names lists they tend to dwell on the difficulties of reconciling conflicting opinions about the correct circumscription of species or genera. They cite instances where specialists disagree on the delimitation of the groups to be recognized and therefore on which names should be considered correct and which as synonyms. Such situations do occur, indeed they are probably inevitable in a discipline such as taxonomy which has been described as an 'artful science'. However, experience has shown that instances of irreconcilable differences of taxonomic circumscription are in fact the exception rather than the rule and certainly affect no more than 10% of names at species level (R. Govaerts, personal communication). Although 10% may seem sufficiently high to be a cause for concern it is lower than many plant systematists might have anticipated. For the conservation community, who have waited decades for such a list, a 90% consensus list now is likely to be more welcome than further explanations of why a perfect list is an unattainable target.

(b) *Hidden synonymies*

In fact, the most significant difficulty faced by compilers of accepted name lists for plants is an extreme form of the problem faced by the compiler of any biological name list, and discussed above, i.e. the dispersed nature of the primary literature. The breadth of literature in which new synonymies appear is somewhat greater than that in which new names are published but there is a key difference: to put a name in synonymy is not a formal nomenclatural act. Some authors choose to flag up new synonyms with the tag '*syn. nov.*' but this practice is by no means universal. In general, spotting and documenting new synonymies is a far more challenging task than recording nomenclatural novelties, which tend to be presented for publication in a much more codified form. Monographs and regional floristic works offer useful summaries of some published synonymies but their coverage is spatially and temporally uneven. Thus the compilation and maintenance burden involved in a comprehensive and up-to-date accepted names checklist is significantly greater than in a nomenclatural index.

5. RECENT APPROACHES TO NOMENCLATURAL INDEXING

Over the past decade, a growing awareness of the need for reliable lists of accepted names for major groups of organisms, paralleled by the increased availability and accessibility of the Internet, has resulted in a plethora of new electronic names initiatives. These vary enormously in scope and ambition from Species 2000, which simply proposes to provide a single point of access to existing accepted names lists for major groups of organisms and encourage the development of such lists for other groups (http://www.sp2000.org/sp2000org.html), through to All Species which aims to describe and classify all of the surviving species of the world within the next 25 years (http://www.all-species.org/).

It must be emphasized that this review does not seek to compare and contrast these initiatives in a systematic fashion, nor even to inventory them but rather to analyse how certain of these projects have attempted to address one or other of the problems to which nomenclatural indexing enterprises tend to be prone. The issues are viewed very much from a botanical perspective, but some zoological examples are included where relevant.

(a) *Registration*

One of the most controversial of the recent initiatives aiming to facilitate the task of the nomenclatural compiler has been registration of newly published names. Strongly promoted by the International Union for Biological Sciences during the 1990s, registration was advocated as a means of enhancing stability and improving dissemination of information (Hawksworth 1991). In effect, it was an approach to tackling the problem I mentioned above by narrowing the range of literature to be taken into consideration by compilers of nomenclatural indexes. The registration system proposed to the botanical community involved a system of accreditation for scientific journals in which new names might validly be published. Scientists wishing to publish nomenclatural novelties elsewhere would need to 'register' their newly published names by submitting copies of the relevant publication to one of a network of registration offices worldwide. The bureaucracy involved in the proposed new system was so elaborate and extensive that it was considered by many to outweigh the potential benefits of a more fully comprehensive list of plant names. Indeed, the anticipated benefits could truly be said to be marginal given that the existing plant name indexes were estimated to include 99.5% of all species and genus names ever published for plants and that registration, if implemented, would affect only newly published names, so that even decades after adoption, the registered names would still represent only a small fraction of all names ever published. Turland & Davidse (1998) spoke for many when they dismissed registration of plant names as 'undesirable, unnecessary and unworkable'. The botanical community rejected the inclusion of registration as part of the Botanical Code at the International Botanical Congress in 1999. The zoological community also rejected mandatory registration in the mid 1990s but the notification proposal was finally included in the current (fourth) International Code of Zoological Nomenclature (Zoological Code) (ICZN 1999) as a recommendation and the debate on this subject seems to have revived recently (see under Index to Organism Names below).

(b) *International Plant Names Index*

The timing of the first public announcements about the IPNI led the more Machiavellian of the botanical community to infer that the project had been designed as the

final nail in the coffin of the plant name registration initiative. In fact, the original motivation of the Plant Names Project (the consortium formed by the Royal Botanic Gardens, Kew, the Harvard University Herbaria and the Centre for Plant Biodiversity Research, Canberra, to develop IPNI) was quite different. The main drivers of change were the desires of each institution to improve the accessibility of their home-grown databases and rationalize the use of limited resources for data compilation and maintenance by minimizing duplication of effort between institutions.

As the project plans evolved, it became clear that with increased access to the data there would be increased opportunity for users to discover errors and omissions in the records. An important decision was taken to turn this potential weakness into a strength, by actively encouraging the botanical community to identify and address deficiencies in the index. Rather than attempting to ease the burden of the compilers by narrowing the field of biological literature in which new names might appear (the registration approach), the Plant Names Project sought to increase the workforce available by making every user a potential contributor to the compilation and maintenance effort. A sophisticated 'contributions mechanism' was conceived to facilitate this process in an automated fashion and widely touted as the ideal means of managing a collaborative community-wide endeavour (Croft *et al.* 1999). Within three months of its formal launch in mid-2000, IPNI was recognized as 'authority data server' for plant names and has topped the list of URLs suggested by Google for plant names ever since. Three years later, IPNI now responds to more than 18 000 queries per day, and additions and corrections to the data are submitted by users all over the world. These submissions are, for the most part, handled by a project editor who assesses their content and makes changes to the data accordingly. The long-awaited software to support the contributions mechanism has just been made available to the compilers and is now being tested before being released more generally. Correspondence with regular users suggests that the desired sense of community ownership has indeed been created but as much through personal interaction between editors and users as through the Web interface. It remains to be seen whether the contributions mechanism will radically alter the way in which regular users interact with IPNI and whether any increase in feedback and improvements to the database will prove proportionate to the cost of developing the contributions software.

(c) *Index to Organism Names*

The prototype of ION was developed by BIOSIS in response to the debate over registration of zoological names. The objective was to allow public access to some of Zoological Record's taxonomic authority files as a demonstration of how taxonomists would be able to verify that their names had been picked up by the registration process without being required to purchase Zoological Record, then being proposed for adoption as the official register (Dadd 1998). The central component of ION is a window on the Zoological Record data, which allows the user to determine whether a name has been documented in Zoological Record and who the author is but does not provide the reference to the publication(s) in which the name appears. The omission of these bibliographic details is intended to protect the existing paid-for services, which provide the revenue stream that supports (but does not fully fund) the ongoing database production (Dadd 1998). As such, it can be seen as a response to the funding problems outlined in § 2b. In addition to checking the name and its author(s), the user can query ION to learn to which group an organism belongs and how frequently the name has appeared in Zoological Record in the past 25 years (a useful indication of levels of usage). ION also allows access to similar data for bacteria (from the BIOSIS Register of Bacterial Nomenclature) and for mosses and fungi (through partnerships with CAB International (CABI), United States Department of Agriculture (USDA) and Missouri Botanical Garden). The ION database now includes over 1.5 million names at all levels from Zoological Record, plus names from the other partner databases (N. Robinson, personal communication) making it arguably the largest biological names server freely available over the Internet today. Furthermore, it is undoubtedly the name server with the greatest growth potential, because most of the world's undescribed organisms are insects or fungi.

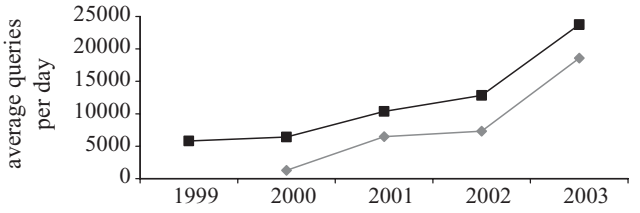

Figure 1. Trends in daily use figures for the IPNI (diamonds) and Missouri Botanical Garden's TROPICOS system (squares) since 1999.

Curiously, patterns of usage of ION are not what one might expect for such a huge and potentially important database. The ION system was made publicly available without charge in April 1997 and by June 1998 was responding to 250 searches per day (Dadd 1998). By May 2003 it included over 1.5 million names at all levels and was receiving just 500–750 queries per week (N. Robinson, personal communication). Thus, levels of usage of the system are low and actually appear to have fallen by 50% or more over a 5 year period which has seen huge expansion in the use of the Internet in general and particularly rapid growth in the use of other databases that are comparable to, but not direct competitors with, ION. Figure 1 illustrates trends in the use over the past 5 years of IPNI and of TROPICOS, another major botanical nomenclatural index, discussed below. IPNI is probably the more comparable with ION, because the databases are of similar size, both index all published names without comment on their taxonomic status (accepted or not), and their potential audiences can be presumed to be broadly similar. Strikingly, levels of usage of IPNI are some 150 times greater than those of ION.

It is tempting to attribute the difference in usage to the most conspicuous difference in content between IPNI and ION, namely the absence of a bibliographic citation for each name included in ION. There may, however, be other explanations. The more compartmentalized nature of zoological taxonomy and the zoological literature may

mean that a specialist is more likely to use an index dedicated to his or her particular group rather than a general listing for all classes of animals. Furthermore, most professional zoologists in developed countries probably have desktop access to Zoological Record, which they might use in preference to ION, whereas IPNI is used by both professionals and amateurs worldwide. Whatever the reason, the relatively low levels of usage suggest that ION may be less useful than might reasonably have been anticipated at the time of its development and launch. Dadd (1998) highlighted the need for information about taxonomic names and, in particular, a straightforward way of finding out what they are, where they belong, and where to find out more. ION fails to deliver on this last question because economic constraints dictate that the onward link to more information can only be made available to those in a position to pay for access to Zoological Record. In this instance the perennial trade-off between enhanced access and security of future funding seems to have resulted in a product of somewhat restricted utility.

As this paper was in preparation, BIOSIS issued a news release reporting agreements with new vendors and 'increased availability to make sure that everyone who wants Zoological Record access can get it'. Elsewhere, the editor of Zoological Record (Thorne 2003) announced enhancements to ION including improved search mechanisms and additional content. Reading between the lines, one may hope that a significant broadening of the (paying) user community for Zoological Record could elevate the entire indexing operation to a sufficiently firm financial footing within BIOSIS to allow improvements to ION, which might allow it in turn to fulfil its true potential as a free name server for the whole community.

Whatever the outcome of this current adjustment to the balance between access and funding considerations, BIOSIS is to be commended for its ongoing commitment to Zoological Record, which is reflected not least in its subsidy of the operation by as much as half a million dollars each year (Dadd 1998). One might argue, as Dadd did, that this financial burden should be borne at government or international level because nomenclatural indexes should be seen as part of global infrastructure. However, because Zoological Record has survived in non-governmental hands since it was founded in 1864 (Thorne 2003), its long-term interests might best be served by a continuation of the current ownership arrangement but underpinned by more secure and broad-based funding.

(d) *TROPICOS*

W^{3}TROPICOS provides Internet access to the Missouri Botanical Garden's VAST (Vascular Tropicos) nomenclatural database and associated authority files. This is a hugely successful botanical Web resource, which offers names data with references and type information as well as links to specimen data and images.

In many ways TROPICOS straddles the divide between nomenclators and accepted names lists. Accepted names and synonymies encountered in the literature are recorded in the database but there is no attempt to adopt a single consistent view on the status of any particular name. Thus, in cases where conflicting views are expressed in the current literature, two different names may be accepted for the same species (or other taxon) within TROPICOS. In effect, the compilers have sought to circumvent the problem of differing taxonomic opinion by telling both sides of the story. This pluralist view has the advantage of being neutral and not requiring great taxonomic expertise on the part of the compiler. It also meets the needs of many experienced botanists in pulling together and summarizing the scattered literature on particular species, so that they can consider the available evidence and make up their own minds. However, it can be extremely confusing for less experienced users, as it does not necessarily help them to choose a name from those offered. TROPICOS itself certainly does not meet the requirements of the conservation community for a comprehensive and unambiguous working list of (accepted names of) known plant species but it contains a large proportion of the resources necessary to produce such a list. Indeed, it has already provided much of the baseline information for national accepted plant names lists for some of the most biodiverse countries of Latin America including Peru and Ecuador (Brako & Zarruchi 1993; Jørgensen & León-Yanez 1999).

(e) *World checklists and bibliographies*

A small checklist team based at the Royal Botanic Gardens, Kew, has been probably the most prolific producer of taxonomically circumscribed accepted name lists for plants over the past decade. A family-by-family approach has been adopted as the most efficient way to survey the literature and capture as many synonymies as possible. Downloads from Index Kewensis, and more recently from IPNI, provide the raw materials for the checklists and a single compiler works these up into draft accepted names lists with synonymies which are then extensively checked by teams of taxonomic specialists at Kew and elsewhere. Completed checklists are published in hard copy in the first instance and, eventually, on the Kew Web site, as well as being made available to other names initiatives such as the International Organization for Plant Information and Species 2000. Checklists for Araceae, Euphorbiaceae, Fagales, Magnoliaceae, Sapotaceae have been published so far. Drafts for Lamiaceae, Myrtaceae, Rubiaceae are currently in review.

In 2001 a decision was taken to focus the checklist work on the monocotyledons, one of Kew's major areas of expertise, and it is anticipated that checklist treatments for all monocotyledon families will be complete by 2005. This represents a significant contribution to meeting the GSPC target of a working list of all known plant species. However, the rate of production of complete checklists will need to be accelerated if the target is to be met. For larger families, taxonomic refereeing has been the rate-limiting step in the production process (A. J. Paton, personal communication). However, this step is critical to the quality of the finished product since it is at this stage that the problem of differing taxonomic opinions (outlined in § 4a) is addressed. It also provides an opportunity for experts to draw attention to synonymies published in obscure literature, which may have been overlooked by the compiler (see § 3b). The challenge now is to find ways of stepping up production of the draft checklists and streamlining the taxonomic refereeing process so that more draft checklists can be brought to final form more quickly. Any effective solution is likely to rely on greater involvement from the broader botanical community, as in the case of IPNI.

Wider participation in and ownership of the checklists might increase their prestige and encourage more specialists and their institutions to contribute more time to the process. It may also help to address the major challenges involved in ongoing maintenance of the growing body of checklists. Unfortunately, the nature of the data and the underlying decision-making processes are much more complex and somewhat less objective than is the case for IPNI. On the positive side, the eventual product is likely to have much broader appeal to a very wide range of potential users and one may hope that the project may be correspondingly attractive to potential funders.

6. DISCUSSION AND CONCLUSIONS

It would be foolhardy to draw hard and fast conclusions from this small and unscientific sample of initiatives surveyed from a very personal perspective. Nonetheless, the temptation to derive some generalizations from the experiences documented can scarcely be resisted. As with all of the commentary that has preceded them, the following observations should be taken as mine alone and not necessarily those of my institution or of any partnerships or collaborative ventures in which I, or Kew, participate. They are phrased here in terms of a series of potential pitfalls facing those embarking on a major indexing or checklisting project, followed by some corollaries of a more positive nature.

(i) Major institutions may dominate big projects and impose their own views to such an extent as to make broad acceptance of the product by the user community difficult or problematic. Where the process is simple and output is largely objective, as in the case of a nomenclatural index, this may be less of a problem than where the process is complex and the product attempts to offer taxonomic judgements, as in the case of an accepted names list. Broadly speaking, the more subjective the output, the more important it is that it should reflect the broadest possible community input, to maximize the possibility of achieving buy-in and consensus.

(ii) Attempts to render the task of compilers more manageable by modifying the habits of taxonomists have failed repeatedly and seem likely to continue to do so as long as these proposed innovations are presented in terms that are open to interpretation as restricting working practices.

(iii) Specialist taxonomic input continues to be the limiting factor in the production of an authoritative working list. In the absence of such input the community can at best expect draft checklists reflecting the understanding of a non-specialist compiler, or compendia, which present all the alternatives but fail to provide the user community with the single internally consistent list it requires.

(iv) Economically viable nomenclatural indexing projects are as rare as hens' teeth. The economics of accepted names enterprises are less well understood than those of nomenclatural indexing projects but the bottom line is unlikely to be more favourable, given the added complexities of the task. To saddle such projects with the requirement to break even in financial terms is to severely restrict their chances of reaching their full potential audience with a quality product.

What does this mean for the proposed working list of all known plant species? Or indeed, for other large-scale nomenclatural indexing or checklisting operations? It suggests that the following may be important criteria to be met in the planning of any major checklisting operation.

(i) The working list requires a funding model that will make it free to all at the point of use.

(ii) The lists should be easily accessible from as early as possible in their development.

(iii) Input by interested parties should be invited and facilitated at a variety of levels to ensure the broadest possible participation in the work.

(iv) In cases of taxonomic disagreement or controversy every attempt should be made to find a consensus. Where such attempts fail, the working list should indicate a single view, or, if alternatives are presented, one internally consistent set of names should be flagged as the preferred view within the list. Unlike the average taxonomist, the average user of the list will not want to be given the data and allowed to make his or her own mind up.

Although some of the above may read like an exercise in stating the obvious, it is my experience that few, if any, of the existing initiatives meet all of the above criteria. Ongoing stakeholder consultations about Target 1 of the GSPC will no doubt bring to light other important considerations that should be taken into account when planning and developing the working list.

Were Darwin alive to see the Index Kewensis in its 110th year he might marvel at the rate at which taxonomic novelties are still being discovered and described or regret that his original vision of a list of all known plant species has not, as yet, been realized. There can be little doubt though, of his satisfaction at the idea that his original bequest of 'about £250 annually for 4 or 5 years' has resulted in a reference work considered so valuable that the UK Government continues to provide funds to update and maintain it more than a century later. One can only hope that by 2010 the working list of names of known plant species will be sufficiently complete and authoritative as to be considered an essential tool for biodiversity workers worldwide, and that the taxonomic community and governments alike will invest in its upkeep and improvement.

Note added in proof.

Further to § 5c, in January 2004 the Thomson Corporation announced that it had acquired the publishing assets of Biological Abstracts, Inc. and BIOSIS, including Zoological Record. It is envisaged that the BIOSIS product line will be incorporated within ISI Web of Knowledge.

The views presented here reflect my current perspective, which has evolved as a result of formal and informal conversations and discussions over several years with many colleagues, most notably Christine Barker, Dick Brummitt, Katherine Challis, Martin Cheek, Peter Crane, Jim Croft, Rosemary Davies, Vicki

Funk, Rafael Govaerts, Werner Greuter, Sally Hinchcliffe, Mark Jackson, Bob Magill, Alan Paton, Peter Raven, Nigel Robinson, Peter Stevens, Nigel Taylor, Joan Thorne and Judy West. I am grateful to these and many others for their generosity with respect to their time and their ideas. However, they should not be held accountable for any errors of fact or interpretation in the present work.

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GLOSSARY

GSPC: Global Strategy for Plant Conservation
ION: Index to Organism Names
IPNI: International Plant Names Index