

Southern African plant systematics: needs, priorities and actions

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With well over 30 000 vascular plant species, southern Africa has the richest flora of any region of comparable size in the world. For the purpose of this paper, 'southern Africa' includes Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe. Here, at the southern tip of the African continent, more than 10% of the world's vascular plant flora is concentrated on less than 2% of the earth's land-surface area.¹ An estimated 70% of the plant species and infraspecific taxa are endemic to the region. Higher order taxonomic diversity and endemism is also exceptionally high. Hence, southern Africa harbours two of the world's six floristic regions or kingdoms, including the whole of the Cape Floristic Region, the smallest and perhaps most remarkable of them all.² Not surprisingly, several so-called centres of plant diversity (CPDs), endemic-rich botanical sites of global conservation significance, are located in southern Africa. Of the approximately 235 CPD sites recognized worldwide by the World Conservation Union (IUCN) and World Wide Fund for Nature (WWF), 84 are located in Africa. Of these, no fewer than 14 are in southern Africa, together covering by far the largest surface area (about 50%) of such important sites in Africa.³

The International Convention on the Conservation of Biological Diversity (ICCBD, commonly known as the Rio Convention),⁴ launched in Rio de Janeiro during June 1992, has focused renewed attention on the rapid global loss and degradation of natural ecosystems. It is anticipated that all southern African countries will eventually be co-signatories of this convention. As the custodians of a significant proportion of the world's flora, these states have a particular responsibility towards meeting their obligations under the Rio Convention. In this regard plant systematists (like all systematists) have a key role to play, because the recognition, labelling and interpretation of genetic variation in organisms is at the heart of systematics.

Efforts by plant systematists to facilitate conservation of southern Africa's botanical diversity are hampered by inadequate information on the vast majority of the subcontinent's plants. The extraordinary richness of the southern African flora places heavy demands on the relatively few plant systematists active in the region. Currently, South Africa houses most of the region's plant systematists, as well as the largest collection of herbarium specimens. This expertise resides mainly at universities, and at the National Botanical Institute of South Africa (NBI),⁵ one of the most important organizations addressing selected botanical research issues in the subcontinent. South Africa, and in particular the NBI, is therefore well positioned to play a key role in providing much-needed botanical expertise. There is a great need to consolidate such expertise and to build the local capacity required to meet current and anticipated future demands.

In September 1993, Brian Huntley, chief director of the NBI, convened a regional conference on the conservation and utilization of southern African botanical diversity.⁶ This initiative followed South Africa's successful transition to a democratic state and thus the removal of an important impediment to the establishment of a regional network of botanists. But does southern

African plant systematics really have the leadership, infrastructure, manpower and vision to meet the immense plant systematics needs and expectations of the subcontinent?

In 1979, the South African National Committee for the International Union of Biological Sciences (IUBS) launched an investigation into the domestic state of biological systematics. In the resulting report⁷ the overall conclusion reached was that the condition of systematics in South Africa '... is gloomy and it appears to have deteriorated in the recent past ...'. One of the main recommendations of the committee was that a national coordinated effort be made to stimulate systematics research and training. In August 1986, the Council of the South African Association of Botanists (SAAB) issued a statement⁸ unanimously supporting the establishment of a National (Stimulation) Programme for Plant Systematics by the CSIR. The CSIR responded by establishing a working group for the Stimulation Programme on Plant Systematics within its Foundation for Research Development (FRD; later an independent body), which held its first meeting on 26 February 1988.⁹ Since 1988, the Plant Systematics Stimulation Programme (later the Working Group for Plant Systematics) has arranged a range of activities aimed at enhancing the professional competence and productivity of local plant systematists (Table 1). These efforts have undoubtedly contributed significantly to raising standards. The time has now arrived for local plant systematists to produce and implement a realistic plan of action aimed at addressing the most important needs and priorities for southern Africa as a whole.

On 17 January 1996, at the 22nd Annual Congress of SAAB, hosted by the Department of Botany, University of Stellenbosch, a one-day symposium was held entitled 'Priorities in Plant Systematics Research in southern Africa'. This meeting was arranged following deliberations amongst the community of plant taxonomists at the 1995 SAAB congress. During the annual general meeting of the Working Group for Plant Systematics (WGPS) of the FRD held at the Free State venue, it was decided that the recent socio-political changes in the country called for an examination of the unity and needs of plant systematics in South Africa, within the southern African context. This paper reports on the proceedings of the Stellenbosch symposium, which was arranged by Ben-Erik van Wyk and Gideon Smith under the auspices of the WGPS and the NBI.

The symposium was divided into a morning session of formal, invited presentations and an afternoon workshop. During the workshop a wide variety of topics were discussed by the plant systematists present. This was done by establishing breakaway groups where the participants chose the topic (see list below) in which they were most interested. Since the levels of detail contained in the contributions received from the group coordinators varied greatly, the summaries presented below have been edited by the authors of this paper to introduce some measure of comparability. Identical ideas also emerged from more than one group and these were consolidated under the most appropriate topic (with cross references if necessary). Although the authors of the present paper have tried not to impose their own opinions and

Table 1. Activities of the Plant Systematics Stimulation Programme (later the Working Group for Plant Systematics), partially sponsored by the Foundation for Research Development.

No.	Activity	Date	Venue	Convenor	Presenters	No. of participants
A. Workshops and training courses						
1.	Phytochemistry colloquium	15 Jan. 1988	National Botanical Gardens, Kirstenbosch	G. Scott	W.F. Campbell E.R. Robinson P. Brain A.M. Stephen K. Steiner S. Compton	c. 50 and 14th SAAB Congress delegates
2.	Immunology and protein electrophoresis	4-7 July 1988	Dept. of Botany, University of Natal, Pietermaritzburg	C.H. Stirton	E.R. Robinson	*
3.	Numerical phenetics	9 Jan. 1989	Margaretha Mes Institute for Seed Research, University of Pretoria	P.L.D. Vincent	P.L.D. Vincent	c. 40
4.	Chemosystematics:					
	(i) Enzyme electrophoresis	16-20 Jan. 1989	Margaretha Mes Institute for Seed Research, University of Pretoria	E.R. Robinson S. Grant	E.R. Robinson S. Grant R. Lester	13
	(ii) Flavonoids	16-20 Jan. 1989	Margaretha Mes Institute for Seed Research, University of Pretoria	F. Getliffe Norris K. Balkwill	J.B. Harborne	13
	(iii) Alkaloids	16-20 Jan. 1989	Margaretha Mes Institute for Seed Research, University of Pretoria	B-E. van Wyk	B-E. van Wyk M. Bredenkamp	12
5.	Workshop on cladistics	(a) 1989 (b) 1989	Dept. of Botany, University of Natal, Pietermaritzburg Dept. of Botany, University of the Witwatersrand	C.H. Stirton P.L.D. Vincent	H.P. Linder	* c. 15
6.	Plant cytogenetics	5-7 July 1989	Dept. of Botany, University of Natal, Pietermaritzburg	C.H. Stirton	J.J. Spies L. Saayman H. du Plessis	30
7.	Workshop on pollination biology	1989	Midmar Dam, Natal	C.H. Stirton	C.H. Stirton E.R. Robinson H. Baijnath	*
8.	Convenient computerized taxonomy: the DELTA system	9-12 July 1990	Dept. of Botany, University of the Witwatersrand	P.L.D. Vincent K. Balkwill	G.E. Gibbs Russell P.L.D. Vincent K. Balkwill	22
9.	Advanced course in plant nomenclature	(a) 28-29 Jan. 1991 (b) 21-22 Mar. 1991	National Botanical Institute, Pretoria National Botanical Institute, Kirstenbosch	A.E. van Wyk A.E. van Wyk J.P. Rourke	D.J.B. Killick	50 40
10.	Palynology workshop	25-27 Mar. 1992	Dept. of Botany and Genetics, University of the Orange Free State	L. Scott R. Verhoeven	L. Scott	*
11.	Molecular systematics workshop	13 Jan. 1993	Dept. of Botany, University of the Western Cape	N. Barker	N. Barker D. Crawford E.R. Robinson	19th SAAB Congress delegates
12.	Preparation of: (i) text and (ii) artwork for publication	(i) 17 Feb. 1993 (ii) 17-18 Feb. 1993	(i) and (ii): National Botanical Institute, Pretoria	(i) and (ii): O.A. Leistner	O.A. Leistner G.S. Condy	24 20
13.	Cladistics for plant taxonomists	(a) 26 April 1993 (b) 3 May 1993	Stellenbosch National Botanical Institute, Pretoria	B-E. van Wyk	B-E. van Wyk	26
14.	Phytogeography workshop	7-8 Jan. 1994	Dept. of Botany, University of the Witwatersrand	G.F. Smith K. Balkwill	P. Stott	57

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Table 1. Activities of the Plant Systematics Stimulation Programme (later the Working Group for Plant Systematics), partially sponsored by the Foundation for Research Development.

15. Plant nomenclature: 1994	(a) 7–8 Nov. 1995	National Botanical Institute, Pretoria	G.F. Smith	D.J.B. Killick	34
<i>International Code of Botanical Nomenclature</i>	(b) 12–13 March 1996	National Botanical Institute, Kirstenbosch	G.F. Smith	D.J.B. Killick	26
B. Symposia					
16. Systematics, biology and evolution of some South African taxa	18 Jan. 1990	1820 Settlers Monument, Grahamstown	H.P. Linder	P. Goldblatt H.E.K. Hartmann E.G.H. Oliver H.P. Linder B-E. van Wyk	16th SAAB Congress delegates
17. Species and speciation	17 Jan. 1992	Dept. of Botany, University of Durban-Westville	H.P. Linder	C.J. Humphries + 5 S.A. speakers	18th SAAB Congress delegates
18. Floristics	11 Jan. 1994	Dept. of Botany, University of the Witwatersrand	K. Balkwill	P. Stott R.K. Brummitt + 36 S.A. speakers	20th SAAB Congress delegates
19. Chemical and molecular systematics	12 Jan. 1994	Dept. of Botany, University of the Witwatersrand	B-E. van Wyk	B-E. van Wyk + 18 S.A. speakers	20th SAAB Congress delegates
20. Priorities in plant systematics research in southern Africa	17 Jan. 1996	Dept. of Botany, University of Stellenbosch	B-E. van Wyk G.F. Smith	J. West L.A.S. Johnson G.F. Smith K. Balkwill H.P. Linder B-E. van Wyk A.E. van Wyk	22nd SAAB Congress delegates
C. Collecting trips					
21. Noodsberg, Natal	8–15 Oct. 1989	—	A.E. van Wyk	—	19
22. Blouberg, northwestern Transvaal	2–9 Dec. 1990	—	S.P. Venter	—	c. 50
23. Klein Swartberg, Little Karoo	2–5 Feb. 1992	—	J.H.J. Vlok H.P. Linder	—	14
24. Songimvelo Game Reserve, southeastern Transvaal	6–12 Dec. 1992	—	K. Balkwill	—	26
25. Touwsberg, Little Karoo	4–8 Oct. 1993	—	M. Stalmans D. Paterson-Jones N. Barker	—	27

* Data not available.

emphasis on what they regard as feasible and important, the ideas presented below may differ from what the group coordinators had in mind. The following matters were discussed under the chairmanship of group coordinators (listed in parenthesis):

HERBARIA

- 1) Networking southern African herbaria (Ashley Nicholas).
- 2) Plant collecting programme for undercollected areas (Marinda Koekemoer).
- 3) Indicating conservation status in monographs and floras, and on specimens (Craig Hilton-Taylor).
- 4) Standard use of data on plant species distribution (Abraham van Wyk).

TRAINING

- 5) Capacity-building in plant systematics (Rose Williams).

SYSTEMATICS RESEARCH

- 6) Studies of phylogenetic and species-level diversity (Nigel Barker).

- 7) Regional directories of botanical information, specialist taxonomists and checklists (Trevor Arnold).
- 8) International liaison (Peter Linder).

PROMOTING PLANT SYSTEMATICS

- 9) Promoting and marketing plant systematics (Ben-Erik van Wyk and Gideon Smith)

Following the discussions, a combined feedback session was coordinated by Lawrence Johnson and Gideon Smith, during which the various chairpersons presented the brief reports and recommendations generated by their groups.

Herbaria

- 1) *Networking southern African herbaria*

Herbaria are an integral and essential part of all botanical research, and in particular provide the cornerstone for systematics, biogeographical and floristic studies. It is usually only in the herbarium that all the related species of a genus can be compared in the same place and at the same time.¹⁰ Furthermore, herbarium

collections form the archives of the natural plant resources of a country and must therefore be considered irreplaceable national assets.⁵

Over the last few years local herbarium curators have had the opportunity to discuss matters of common concern in the Southern African Herbarium Curators Working Group (SAHCWG). This is a formally constituted subcommittee of SAAB, created to attend to the needs of the taxonomic community of the region. A secretariat is elected to hold office for a period of not less than two years. This body represents a potentially powerful negotiation forum, the strengths of which have not been realized to date.

In addition, a Network of African Herbaria (NOAH) was established at the 1991 congress of the Association pour l'Etude Taxonomique de la Flore d'Afrique Tropicale (AETFAT) held in Malawi. To date, this network has started a *Newsletter*¹¹ aimed at distributing news and information relevant to herbaria in an African context.

These two networks, one for southern Africa and the other for Africa (including southern Africa), were established to promote communication amongst herbaria and to act as a united voice on their behalf. Furthermore, the networking of resources and sharing of expertise will prevent unnecessary duplication, and promote the most efficient use of both materials and skilled people.

The NBI's National Herbarium in Pretoria, the largest in southern Africa, is at present the only major subcontinental herbarium that is computerized. Known as PRECIS (for PREtoria Computerized Information System), this electronic herbarium specimen and taxon database aims to make a vast amount of herbarium specimen information available for computer search and to facilitate environmental planning and plant systematics research.⁵

As a first step in strengthening the SAHCWG network, computerized herbarium databases and management systems in the region should have the highest degree of compatibility to facilitate the sharing of data. The NBI is therefore requested to develop and make available a powerful, yet easy to use, herbarium management programme (database) for users of personal computers. It must have curatorial capabilities (such as the printing of labels, and the handling of loan requests) and be fully compatible with the current PRECIS database [see 4) below]. The programme should preferably be made available free of charge, in return for the use of distributional and other information by the central regional facility, PRECIS. However, technical support such as staff training for data handling and programme operation will be essential. All southern African herbaria that want to computerize should be encouraged to use this programme or a fully compatible equivalent. Herbaria that have already developed databases should be encouraged to switch to the new programme. Assistance should be rendered to these herbaria to convert their existing databases to the new format.

All regional herbaria should endeavour to be linked to the Internet by the year 2000. Initially, at least the main herbaria should become part of the network by 1998. Ultimately, all larger southern African and African herbaria should have their herbarium specimen data available for electronic perusal. A further step could then be to provide visual access to herbarium sheets.

2) Plant collecting programme for undercollected areas

Plant collections, and in particular their label information, are vital and fundamental to systematics. The herbaria of the NBI currently house approximately 1 500 000 herbarium specimens. An estimated additional 1 600 000 specimens are available in other regional herbaria. Yet many, if not most, parts of the sub-

continent remain vastly undercollected. In addition, early and even many recent herbarium specimens seldom have detailed locality and habitat data. Nor do most of the labels reflect much-requested contemporary aspects such as population size and conservation status.

The NBI has had a National Plant Collecting Programme for a number of years. This programme is aimed primarily at a better coverage of the region in terms of herbarium specimens.^{12,13} However, the NBI has limited resources to bring such a comprehensive programme to fruition, and support from other herbaria and plant collectors in the region will be imperative. For example, the subcontinent could be divided into areas for each of which a regional herbarium and/or certain plant collectors accept responsibility. These activities will necessitate funding to enable systematists and plant collectors to visit undercollected areas at different times of the year. This will ensure the highest possible seasonal coverage of plant diversity in a region. Such effort would require active participation by amateur botanists and landowners, who should be given a short training course and be provided with the necessary equipment. Financial compensation could even be considered.

A special effort should be made to improve the quality of label information accompanying each collection. This information on most existing herbarium collections is inadequate for most taxa. Quality specimens with detailed label information are urgently required for most taxa. Modern collections reflect more accurately on the continued existence of a taxon in a particular area. All plant collectors should record localities at the finest possible resolution and highest degree of accuracy, preferably as coordinates specified to seconds [see 4) below].

This ongoing plant collecting programme will need to be supported to achieve the goals of the Rio Convention and in particular the development of a regional resource for plant distribution data in southern Africa [see 4) below]. Such a facility will be indispensable to signatory governments as a means of ensuring optimal management and sustainable utilization of the subcontinent's plant diversity.

3) Indicating conservation status in monographs and floras, and on specimens

The identification of threatened taxa is a prerequisite for their conservation. Centres of endemism must be recognized for the conservation of diversity to be meaningful and efficient. In both these activities plant systematists have a key role to play. However, information gathered by plant systematists is not useful if it is not accessible to decision-makers and conservation authorities. The updated *Red Data List of Southern African Plants* is currently in press.¹⁴ Much of the information in this document is dependent on the involvement of plant systematists. The following two procedures in particular need closer attention to facilitate conservation activities.

First, much of the information concerning threatened plants is derived from and dependent on herbarium specimens. Most herbaria are not static; new accessions are constantly being made to the collections, specimens are studied and taxonomic or nomenclatural changes could result. At present there is no system to convey this new information (especially the accessions which may represent newly discovered populations and/or localities) to the conservation authorities and national Red Data plants co-ordinators. In September 1994, Craig Hilton-Taylor, South African Red Data plants co-ordinator, presented a proposal to the SAHCWG requesting that all herbaria place a marker (e.g. a coloured sticker) on the folders of every taxon considered to be

threatened. These markers would alert herbarium staff that they are dealing with a taxon of conservation importance and that, if they receive a new specimen of the taxon concerned, its identity and locality should be carefully checked. This and other label information should then be relayed to the appropriate authority. Changes concerning these taxa that are noted during routine scientific curation, e.g. nomenclatural adjustments, should also be conveyed to the appropriate authority. A pilot study to implement such procedures at the Compton Herbarium, Kirstenbosch, will begin in 1996 and interested herbarium curators are invited to contact Hilton-Taylor (Ecology Subdirector, NBI, Private Bag X7, Claremont, 7735 South Africa) for further information.

Second, at present the conservation status of new taxa is rarely indicated by those describing them. As a result, liaison is required with each systematist to determine whether particular taxa should be in the Red Data list or not. It is suggested that editors of all the major southern African botanical journals make it mandatory in the editorial guidelines that authors include, wherever possible, the conservation status of each taxon described (be it in a monograph, a contribution to the *Flora of Southern Africa*, or other relevant scientific paper). In southern Africa a decision will shortly be taken on whether or not to accept the new IUCN Red Data categories and criteria.¹⁴ If these are accepted, a workshop may be held (possibly at the SAAB 1997 Annual Congress) so that regional systematists and conservationists can be fully informed about the new system.

4) Standard use of data on plant species distribution

A herbarium specimen that is not accurately labelled is worthless for most types of research. By far the most important single piece of information is the exact locality of a collection. Following the proposal of Edwards and Leistner,¹⁵ botanists in South Africa have adopted a degree reference system for citing plant records. At present distributional information from the PRECIS database can be requested only up to a spatial resolution of a quarter-degree square, an area of more than 600 km². The precise locality is usually given in the form of a descriptive phrase. Considering the sessile nature of plants, the erratic distribution of most rare taxa, and the often marked ecological gradients that exist over short distances, distributional information at this resolution is far too generalized for most environmental management purposes.

The growing use of geographical information systems (GIS)¹⁶ by environmental consultants and planners often requires data at the resolution of point accuracy, thus rendering most existing herbarium collections in southern Africa of less than perfect use. To realize the maximum potential of GIS (not only for environmental management but also for taxonomic research) and to ensure the provision of information required by users of plant distribution data, it has become inevitable that all future plant collections have well-defined levels of spatial resolution and accuracy. For this purpose, the use of geographical coordinates specified to seconds should be encouraged.

A comprehensive strategy to establish a regional resource for plant distribution (and other) data in southern Africa is urgently needed. Such a resource must endeavour to integrate most available information on plant distributions, at defined levels of spatial resolution and accuracy (see for example ref. 17). Data should be readily available to users. The existing PRECIS database could form the nucleus for the development of such a facility. Initiatives to encourage networking of herbaria would be essential [see 1) above]. This database should eventually be accessible through the Internet and fully compatible with as

many herbarium management programmes of other regional herbaria as possible [see 1) above]. Sensitive data can be masked by aggregating the point data into increasingly generalized levels of resolution. Differential access to the data can be set electronically, depending on the status of the client. Furthermore, the NBI has been requested to establish a GIS facility linked to the above database. This facility would be indispensable for future biodiversity research. To ensure maximal compatibility, such a system should be developed in collaboration with conservation and other bodies, many of which have already developed their own GIS facilities.

All plant collectors should be requested by the NBI to supply locality information for new collections in the form of geographical latitude/longitude coordinates (degrees, minutes, seconds). Spatial accuracy codes should also be supplied (e.g. 1 = GPS; 2 = 1:50 000 map; 3 = 1:250 000 map; 4 = road map; 5 = sight record).¹⁷ NBI is to advise collectors and herbaria on the proposed levels of spatial resolution to be recorded, as well as on the format of the coordinates (decimal or conventional). Quarter-degree grid references should still be supplied. Altitude should be provided wherever possible, but particularly in the case of collections from mountainous areas.

It will be very costly to convert localities on existing herbarium specimens to accurate point data and in many, if not most, cases label information would be too vague to justify such effort. Taxonomists involved in revisionary studies of particular groups should nevertheless be encouraged to convert locality information on older herbarium collections to point data, which could then be added to the central database facility. In addition, extensive field work and plant collecting should be encouraged by the NBI [see 2) above] and other herbaria to ensure the accumulation of more detailed information for the proposed regional database.

Training

5) Capacity-building in plant systematics

Since southern Africa has more than 10% of the planet's flora, one would like to believe that a similar percentage of the world's systematists should currently be working on this rich material. However, current estimates are that only about 60 systematists (or approximately 5% of the world total) are active in southern African botany. This rather disturbing statistic places a big responsibility on research managers to facilitate and implement a capacity-building programme aimed at upgrading the level of expertise available within plant systematics, and at the same time to create new positions in the subject and to improve productivity and existing infrastructure. These new positions should include the full spectrum of herbarium appointments, such as support, technical as well as scientific staff.

The chief director of the NBI has taken the initiative in this regard by securing substantial funding for a southern African Botanical Diversity Capacity Building Programme from the Global Environmental Facility (GEF) of the World Bank, the Regional Office for Southern Africa (ROSA) of the IUCN, and the United States Agency for International Development (USAID).¹⁸ Following wide consultation with the various southern African role-players, this programme will be formally launched in March 1996. Without substantial emphasis on training programmes for local systematists and herbarium managers, southern Africa runs the risk of being unable to meet its global responsibilities (in terms of the Rio Convention) towards the effective and efficient management of the region's wealth of biodiversity. This capacity-building programme will greatly assist southern African countries to develop more expertise in plant

systematics and to maintain high standards in curating their botanical collections.

Systematics research

6) *Studies of phylogenetic and species-level diversity*

The primary objective of systematics is to develop classification systems that reflect genetic and evolutionary relationships of plants. Modern systematic botany is a synthesizing discipline drawing on data from many sources and areas of scientific study. Plant systematics studies integrate the results of disciplines such as morphology, physiology, cytology, palynology, embryology and chemistry into coherent patterns with high predictive value. Thus, in a sense, systematics is a science without data of its own, utilizing the results of investigations in all other branches of biology.¹⁹ In practice, however, lack of sufficient or suitable comparable data produced by others forces systematists to gather most of the data themselves. Original comparative research at all taxonomic levels will therefore always be the cornerstone of plant systematics. Thus it is imperative that such research be encouraged at all levels of intensity appropriate to the problems in hand.

Investigation of phylogeny by molecular techniques (such as DNA sequencing) is now an established modern approach that will undoubtedly play an increasingly important role in improving classifications. At lower taxonomic levels, studies of allozymes and other genetic investigations of population diversity are valuable in particular cases.^{20,21}

The needs of tertiary educational institutions and the employers of their graduates may not always coincide exactly, but it is becoming increasingly evident that closer liaison between potential employee and employer will ensure that priority-driven projects are used in training. Priorities may in future be set according to the users/funders of research projects (for example, germplasm units, horticulturalists, agriculturalists, forensic chemists and systematists themselves).

7) *Regional directories of botanical information, specialist taxonomists and checklists*

In a region where research needs to be increasingly priority-driven, it is important that directories of information, expertise and projects be set up and maintained. To facilitate this process (of either hard copy or electronic data capture), a project-level questionnaire aimed at establishing such databases was recently circulated (from the Data Management Section of the NBI) to systematists involved in regional research projects. This information will be based at the NBI in Pretoria, and kept up to date by means of regular questionnaires and an invitation to systematists to report all new projects to this facility. A database of regional taxonomic expertise will be a useful resource during the NBI/GEF Capacity Building Programme because it will provide opportunities to researchers and managers to identify specialists in particular families or genera in a broad regional context.

In addition, every effort should be made to establish a meta-database of other existing databases of relevance to plant systematics research. Ideally, information carried in the meta-database should include: name of holder, area covered, description (i.e. field covered), and level of coverage.

8) *International liaison*

Plant systematics, like all other branches of science, cannot be practised in isolation. A need for interaction amongst systematists working on related groups will always exist. Systematics

research will always need type specimens and other significant herbarium material to be perused. Until such time that herbarium collections are electronically accessible for the visual selection of appropriate specimens for physical examination, *in situ* studies of comprehensive collections will remain crucial to the successful completion of a monograph or revision. Since most of the taxonomic work in previous centuries on the southern African flora was carried out by British and European botanists, taxonomically important specimens are housed mostly in various northern hemisphere herbaria. In view of the recent abolition of the South African Botanical Liaison Officer (SABLO) position at the Royal Botanic Gardens, Kew,²² it is now more important than ever to seek funding to enable local systematists to visit those herbaria holding important southern African collections. This will also provide the opportunity for local botanists to gain appropriate research experience and to establish personal contact with other colleagues.

To enable local plant systematists to gain experience and successfully complete their research projects, it will be imperative to establish a fund to which submissions for overseas research visits can be made. As a short-term measure to facilitate the acquisition of important literature and specimens, the NBI will be funding a temporary SABLO appointment at Kew.

Promoting plant systematics

9) *Promoting and marketing plant systematics*

Most of the activities mentioned above will succeed only if substantial funding is available to biological systematics in general and plant systematics in particular. Unfortunately, there has not been a single, united voice from all disciplines lobbying for financial support. Unless southern African plant, animal, fungal and microorganismal systematists can get their act together to form a strong interdisciplinary committee to bargain on behalf of systematics in the broadest sense, the funding required to carry on documenting and studying the extraordinary biodiversity of the subcontinent will not be forthcoming. We therefore propose that a National Biodiversity Council of scientists, representative of all major groups of organisms, be established. This council should seize the opportunities currently afforded to systematists to play a significant role in bringing to fruition the resolutions of the Convention on Biodiversity (Rio Convention). Incidentally, the establishment of such a body was advocated as long ago as 1985.⁷

Concluding remarks

With its unsurpassed botanical diversity, southern Africa holds natural resources of global significance. Currently, many southern African herbaria, understaffed and underfunded, stand little chance of meeting the immense challenges of conserving the rich, though dwindling, botanical diversity of the region. After many decades of both political and, to some extent, scientific isolation, the positive socio-political changes that have taken place in South Africa since the early 1990s bode well for the country to become re-established as an important role-player in regional and international affairs, including the sphere of biological science. The prospect of peace and political stability in Angola and Mozambique has created exciting opportunities for networking among systematists of the 10 southern African countries. These changes, along with the current resurgence of interest in biological diversity, also create opportunities for ex-colonial powers to become further involved in assisting southern African countries with financing the development of individuals and institutions.

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Criteria for plant systematics research projects in the National Botanical Institute of South Africa

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Recent changes in the political dispensation of South Africa have had far-reaching effects on all facets of society, including the scientific community. In the spirit of national transformation, it has become necessary to establish guidelines for evaluating plant systematics research projects in the National Botanical Institute of South Africa, in order to obtain and maintain relevance among the many customers and stakeholders of the organization. We propose a set of criteria, phrased as questions, as a guideline for developing research proposals.

Since the early 1990s, major socio-political and economic transitions have been taking place in South Africa. These changes affect the day-to-day existence of every South African and will undoubtedly also influence the work of plant scientists in the country.^{1,2} Plant taxonomists, like others in the scientific workforce,³ are being challenged to reassess their contribution to national needs. During this critical self-evaluation, some questions arise regarding the organization and management of botanical research in South Africa. Which projects should be developed, which should be scaled down or terminated? How much money should be allocated to specific programmes or projects? Who will pay for the research, and why should they? Close examination of the research programmes of national institutions such as the National Botanical Institute (NBI) of South Africa will be necessary to provide answers to these and other questions.

The formulation of a set of criteria for systematics research projects has been one result of the process of self-appraisal in the

NBI. We suggest that all research on systematics, present and future, should be evaluated according to these guidelines. These criteria will help the NBI to ensure that its systematics research programmes and projects are more meaningful in today's changing times, and that they contribute to the improvement of both our social and natural environments.

Systematics research in the National Botanical Institute

The NBI comprises four directorates — Research, Gardens, Education and Information, and Administration. The Research Directorate consists of two subdirectorates, one for Plant Systematics and the other for Plant Ecology. Within the Systematics Subdirectorate, research is conducted at the programme level. Numerous individual projects fall under the three current programmes — Systematics Research, Herbarium Management, and Data Management.^{4,5}

The work of systematics researchers in the NBI has two main objectives: first, to compile an inventory of southern African plants, and second, to contribute to botanical knowledge through original research. An inventory will consolidate existing information on the rich flora of southern Africa. Such a catalogue will help to identify plant groups that qualify for more detailed research, and revisions and monographs of these high priority groups will be encouraged. Aimed at compiling an inventory of southern African plant diversity, PRECIS [National Herbarium Pretoria (PRE) Computerized Information System] is the corporate systematics project of the NBI. PRECIS is a computer database of the southern African flora and consists of a specimen and taxon component. The specimen component is based on southern