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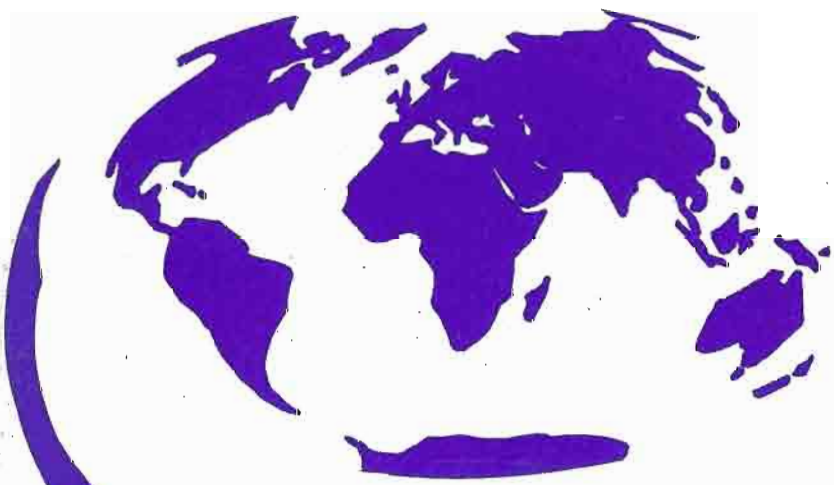

n°19

CONTENTS (N° 19, 1989)

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EDITOR'S NOTE

The major outcome of the last IUBS General Assembly, held in Canberra, Australia, in October, 1988, was the adoption of a three-fold new scientific initiative, consisting of the "Bio-Diversity", "Bio-Complexity", and "Biological Nomenclature" programmes. The present issue of *Biology International* aims at reporting on the progress made toward the implementation of these new initiatives.

The first paper, which is a brief essay entitled "*Environmental Dynamics and Predictability:Toward a Dynamical View of Global Change*", stresses the need to consider complex systems and a nonlinear dynamical view to global change, especially regarding the biological components of the global system.

The following report, entitled "*Improvement of Stability in Biological Nomenclature*", presents the background and general objectives of the programme, and the progress made so far, toward the generation of 'Lists of Generic Names in Current Use'.

Another one, entitled "*Ecosystem Function of Biological Diversity*", describes the objectives, key questions, and potential study areas that were addressed at the small exploratory workshop, organized by SCOPE and IUBS, in Washington, D.C., USA, with the aim to discuss and suggest future activities and a plan of action for the IUBS Programme on Biological Diversity.

In publishing these reports in *Biology International,* we would like to make an appeal to all the IUBS National and Scientific Members, seeking for their support, cooperation and contribution, which are a prerequisite for a successful implementation of these programmes.

Environmental Dynamics And Predictability:Toward a Dynamical View of Global Change

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In this brief essay I would like to present some ideas on the connection between IGBP, the *"International Geosphere-Biosphere Programme: A Study of Global Change"* on the one side, and recent important developments in physical and mathematical sciences on the other, developments which are likely to deeply affect our attitude concerning the description of nature.

IGBP has to do with the study of the basic biological, chemical and physical processes that regulate the Earth's environment. As such, it deals therefore with one of the most *complex systems* encountered in nature. A plausible explanation on the origin of this complexity that comes first to mind is the presence of a great number of variables and parameters, which are hiding some fundamentally simple underlying regularities. A question of obvious relevance is, therefore, to gather on these parameters as much information as possible. Once this is available, the next step is to develop large (numerical) models incorporating the maximum possible amount of variables and couplings, and study the sensitivity of their response when some of these parameters are varied. These two goals are, I believe, at the heart of the IGBP programme.

At this point, however, let us raise the following fundamental question. Is the variability and complexity that we perceive in environmental dynamics to be attributed entirely to the presence of a large number of variables and parameters? Could it not be that complexity is an intrinsic property related to the very nature of the dynamical laws governing the earth-biosphere system? The latter are, of course, nothing else than the same dispassionate physical laws that govern, say, simple laboratory systems or the motion of celestial bodies around the sun, which is known for its regularity and reproducibility. In this sequel I would like to explain why we should pay more attention to the second alternative than we have in the past.

A simple example will allow us to first better understand the meaning of the question. Consider the motion of a fluid in a pipe under a strong pressure difference. It is well known that this phenomenon is described by the Navier-Stokes equation, one of the classical equations of physics, which has a universal form known in all its details. For a given fluid and geometry the parameters intervening in the equation are likewise perfectly well known, as also the boundary conditions. Yet engineers, physicists, or oceanographers have realized for centuries that this motion generates *turbulence*, a

phenomenon which, despite its deterministic origin, displays erratic behavior in space and time, reminiscent, in many respects, of a random process. Clearly, whatever the precision, the resolution, and more generally, the amount of information we can gather on this process might be, it would be impossible to eliminate this variability and describe the unfolding of turbulence in terms of a simple, reproducible algorithm. This is undoubtedly the reason why turbulence remains a major open problem of contemporary science.

As it turns out, far from being an isolated example, turbulence is one of the multiple manifestations of an emerging scientific paradigm that is gradually replacing the classical one, in which emphasis was placed on stability, permanence, reproducibility, and ultimate simplicity. Fluid motions, environmental dynamics and many other systems, for that matter, are *nonlinear dynamical systems* functioning under *constraint.* Such systems are now known to exhibit a variety of complex behaviors of intrinsic origin, such as (1):

i) The co-existence of several simultaneously stable regimes under given values of the parameters;

ii) The emergence of *chaotic dynamics*, whereby initially close states tend to diverge exponentially with time. This *sensitivity to the initial conditions* is perceived by the observer as unpredictability, that is to say, the existence of a characteristic time beyond which predictions on individual histories lose their operational significance. A remarkable, unexpected result is that behaviors of this sort may already arise in systems involving a very limited number (actually as few as three) of variables.

To what extent is the dynamics of the global environmental system operating on this archetype? I shall limit myself to two results arguing in favor of this view. The first one is due to the American meteorologist E. Lorenz (2), who analyzed the operational forecasting model of ECMWF, the "European Center for Medium Range Weather Forecasts". He found on this 600,000 variable model an error doubling time of 2.5 days indicating the presence of a complex, nonlinear dynamics and entailing that beyond this range weather predictions based on this model lose their operational significance.

The second result relates to analyses of atmospheric and paleoclimatic data performed recently using the modern theory of nonlinear dynamical systems (3). These results strongly suggest that the data derive from a chaotic dynamics, whose predictability - or error doubling-time has been estimated.

I believe that the above ideas shed interesting light in the very nature of environmental dynamics and highlight the importance of some new issues that appear to complement in a useful manner those that are already part of the IGBP objectives (4). For instance, if complexity is rooted in the dynamical laws governing the evolution, predictions based on a static view, whereby the system permanently adjusts to a "quasi steady-state" level compatible with the instantaneous values of the parameters are inadequate: they should

be complemented with predictions made on the basis of a dynamical response, accounting properly for the system's tremendous repertoire of variability. This is especially crucial for the biological component of the global system since well known resilience, redundance, evolution and plasticity rank among the most conspicuous attributes of life. As a corollary, sheer vastness of a numerical model of prediction does not automatically guarantee its legitimacy.

More importantly perhaps, in view of the existence of intrinsic limits of predictability, it becomes imperative to invent new observational and modelling strategies for improving our prediction capabilities in order to approach these limits as closely as possible, while being aware that we can never bypass them. It is to be expected that such efforts will eventually lead to a new attitude toward our global environment from which new ideas, new tools, new perspectives are bound to emerge.

References

1) See, for instance, NICOLIS, G. & PRIGOGINE, I. 1989. *Exploring Complexity.* Freeman, New York.

2) LORENZ, E.N. 1982. Atmospheric Predictability Experiments With a Large Numerical Model. *Tellus* 34, 505.

3) NICOLIS, C. & NICOLIS, G. 1984. Is There a Climatic Attractor? *Nature*, 311, 529.

KEPENNE, C & NICOLIS, C. 1989. Global Properties and Local STructure of the Weather Attractor Over Western Europe. *J. Atmos. Sci.*, July issue.

TSONIS, A. & ELSNER, J. 1989. Chaos, Strange Attractors, and Weather. *Bull. Amer. Meteor. Soc.* 70, 14.

4) NICOLIS, C. & NICOLIS, G. (Eds.) 1987. Irreversible Phenomena and Dynamical Systems Analysis in Geosciences. Reidel, Dordrecht.

Improvement of Stability in Biological Nomenclature

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Introduction

The names of organisms are the key to the entire scientific knowledge of them, from the molecular to the ecosystem level. The whole communication and information exchange concerning living organisms, within and without biology, depends on the availability of a stable, well-defined and generally recognized set of designators for organisms linked by common descent with a common set of characters. Biological nomenclature and the rules governing it, are designed to fulfill this need and are generally recognized as one of the basic working tools for biological research and users of biological information.

Changes in names, and worse, changes and uncertainties in their applications, are hinderances to effective communication. Whereas one has to allow for name changes reflecting progress in knowledge and understanding, since Taxonomy as all other disciplines of biology is an on-going developing science, it is urgent that unnecessary name changes as well as uncertainties in the application of names be eliminated as radically as possible. Such changes are those that are enforced merely by strict application of the nomenclatural rules often due to the discovery of obsolete and hitherto overlooked early publications. Uncertainties may result from ambiguity in the application of the nomenclatural rules, from doubts surrounding dates of publication, and from diverging and debatable selections of standards (so-called types) governing the application of names.

In the course of the last 235 years, large numbers of names have been introduced which are of uncertain application, and others not previously catalogued repeatedly come to light. Further, changes in the codes of nomenclature themselves can lead to previously unavailable names have to be resurrected or applied in new senses. Elimination of this "noise" in the nomenclatural systems would have a major effect in reducing the numbers of changes in names for purely nomenclatural reasons. In taking the works of Linneaus (1753, 1758) as the starting points for biological nomenclature, much of the earlier (mainly non-binomial) nomenclatural "noise" was eliminated from the system. The granting of special status ("sanctioning") to the names of fungi accepted in the compilations of Persoon (1801) and Fries (1831-32) alleviated the problem in that group to some extent, while in bacteria the adoption of a new 1980 starting date reduced at a stroke the numbers of species names to be considered from 21000 to 1800 (Sneath, 1986). The need for action on a broad front to

reduce the level of nomenclatural "noise" is long overdue, and is being felt increasingly by those using computerized information systems and databases.

Recognizing the long standing and increasing concern of pure and applied biologists over the lack of stability in the names of organisms, and the confusion this leads to in the whole of biology, IUBS adopted a programme on the *Improvement of Stability in Biological Nomenclature* at the XXIIIrd General Assembly held in Canberra, Australia, on 16-22 October, 1988 (IUBS, 1989). Recognizing the need to minimize the number of changes made for nomenclatural reasons, the General Assembly invited the General Committee for Botanical Nomenclature (IUBS Commission on the Nomenclature of Plants) to appoint a Special Committee on Lists of Names in Current Use. This contribution summarizes the background to this initiative, and the progress made.

Background

Following discussions and resolutions passed at the Third International Congress on Systematic and Evolutionary Biology (ICSEB) in Brighton, U.K., in 1985 (Ride & Younés), 1986), and the IUBS XXIInd General Assembly in Budapest later that year (IUBS, 1985), a Committee for the Registration of Plant Names was established by the General Committee for Botanical Nomenclature in January, 1986, on the recommendation of IUBS.

The Committee met at Kew in May, 1986 and made proposals for the registration of newly published plant names (Greuter, 1986) to the XIV International Botanical Congress (IBC) in Berlin in July, 1987. These proposals were referred to a new Special Committee on Registration charged with reporting to the next IBC, to be held in Tokyo in 1993.

Recognizing the concern over names in current use and not only with regard to newly published names, and following discussions during both the XIV International Botanical Congress and the Third International Taxonomic Database Working Group for Plant Sciences meeting in Edinburgh in October 1987, (Bisby, Sutton and Russell, 1989). IUBS sponsored a meeting of a second ad hoc group including representatives of key organizations and personnel involved in indexing plant names at Kew on 22-23 April, 1988 (Hawksworth and Greuter, 1989).

A preliminary report of the main conclusions of the ad hoc group meeting was also published in *Nature* (Hawksworth, 1988); copies of this are also being included in other newsletters and publications to give increased publicity to the concepts and widen the debate on this fundamental issue.

CONCLUSIONS OF THE IUBS/IAPT GROUP 1988 MEETING

1. The preparation of lists of names in current use is in itself a worthwhile objective. Moreover, it would, if such lists were accorded a special protected nomenclatural status

over all names not in the list by a future International Botanical Congress, promote stability in names by almost entirely eliminating the majority of name changes due to nomenclatural reasons.

2. It is now technically feasible, in the light of machine-readable and card files which have already been compiled, to produce lists of the approximately 36 500 generic names in current use for all groups covered by the International Code of Botanical Nomenclature (Tabel I.), given the necessary international support. The starting point for such a list is the IAPT Index Nominum Genericorum (Farr, Leussink and Stafleu, 1979; Farr, Leussink and Zijlstra, 1986) database held at the Smithsonian Institution, and publication is to be realized in 1991.

TABLE I. Numbers of Accepted Generic Species Compared With Those Proposed

	Generic Names		Species Names	
	In Use	Total	In Use	Total
Vascular Plants	14,000	33,000	220,000	1,100,000
Fungi	5,500	11,000	64,000	250,000
Algae	3,200	6,400	40,000	200,000
Bryophytes				
Mosses	900	3,000	12,000	85,000
Hepatics	450	1,500	5,000	40,000
Fossils				
Macro-	7,500	-	15,000	
Micro-	5,000	-	15,000	
	36,550	54,900	406,000	1,675,000*

*Excluding fossils

3. The situation with respect to the approximately 400 000 species names in current use varies markedly from group to group, and such lists will have to be prepared on a group by group basis; pilot studies can now feasibly be carried out (e.g., legumes, mosses, yeasts) provided that the necessary resources are made available.

4. IUBS, through its Commission on the Nomenclature of Plants, should be encouraged to establish a Special Committee on Names in Current Use charged to make formal and detailed proposals to the next International Botanical Congress with respect to granting special status to the lists of generic names, to consider if appropriate mechanisms for updating them, and to define procedures for the preparation and adoption of species names lists.

5. The newly appointed Special Committee shall work in collaboration with that on Registration already established, which is considering the question of the registration of newly published names. The work of the two Committees is entirely complementary.

6. The proposals developed at the Kew meeting need to be widely publicized to promote

discussion amongst users of names, and not only systematists.

7. IUBS should be encouraged to adopt this task as a part of its forthcoming Scientific Programme for 1988-91, and secure international funding to assist in the preparation of the generic and sample species names lists.

Progress Report

The General Committee for Botanical Nomenclature (IUBS Commission on the Nomenclature of Plants) accepted the General Assembly's initiative to establish a Special Committee on Lists of Names in Current Use to report to the Tokyo Congress. In practice it was decided to also establish two subcommittees, one to undertake the task of preparing the lists, and the other to consider proposals to be made to the next Congress relating to the Lists. The composition of these Committees was announced on 6 March, 1989, as follows:

Special Committee on Names in Current Use
Mandate: To coordinate the work of the Subcommittees and to ensure that they meet their deadlines. Convenor: W. Greuter (Berlin).

A) Subcommittee to Generate Lists of Names in Current Use
Mandate: To prepare lists of names in current use.
Secretary: D.L. Hawksworth (Kew).
Members: F.A. Bisby (Southampton; legume species), R.K. Brummitt (Kew; ferns and phanerogams), W.G. Chaloner (Egham; fossils, with A. Traverse (Pennsylvania; microfossils), M. Crosby (St. Louis; mosses and allies) with R. Grolle (Jena; hepatics), E.R. Farr (Washington, D.C.; ING), P.M. Kirk (Kew; fungi), P. Silva (Berkeley; algae), and G. Zijlstra (Utrecht; ING).

B) Subcommittee to Consider Code Proposals About Names in Current Use
Mandate: To consider proposals to be submitted to the Nomenclature Section at the Tokyo Congress.
Secretary: J. McNeill (Edinburgh).
Members: A. Cronquist (New York), K. Faegri (Bergen); H. Inoue (Tokyo), D.H. Nicolson (Washington, D.C.), P.H. Raven (St. Louis), R. Santesson (Uppsala), F.A. Stafleu (Utrecht), and J. West (Canberra).

The members of Subcomittee A started to work towards the production of Lists of Names in Current Use at the rank of genus after the Kew meeting, and the following paragraphs summarize the progress so far.

Index Nominum Genericorum Database

A copy of the database has been made for use in the Lists project. Computer tapes or discs with the generic names of algae, bryophytes, and fungi have been supplied to coordinators for those groups, and print-outs of fossil names have also been prepared. In addition, newly published generic names of all groups continue to be checked for incorporation and corrections made regarding typifications and other details as part of the on-going

ING programme.

Algae

A tape was received from ING in January, 1989, but some difficulties have been encountered with interfacing software. Hard copy print-outs can nevertheless be used to check for names in use against the "Index Nominum Algarum" cards held at the University of California in Berkeley; about two months equivalent work of an assistant is required for this task, which would enable the work to be completed by the spring of 1990.

Bryophytes (mosses and hepatics)

A preliminary list of moss generic names is about ready for printing and distribution to selected muscologists for review and comment, after having been compiled and reviewed by the three muscologists at the Missouri Botanical Gardens. The distributed list will consist of two parts: a list of names proposed for inclusion, all nomenclaturally acceptable, and a list of all other names, i.e., names not in current use; reviewers will pay particular attention to the letter, recommending which names should be changed in status. There are about 1300 names under consideration.

The entire list of hepatic names has been sent to Dr. R. Grolle, who published an earlier list (Grolle, 1983). He will return the annotated list, with his recommendations after which the list will be split into two categories and distributed to hepaticologists for comment as is being done for the moss list. There are about 700 hepatic names to consider.

The consolidated preliminary list is expected to be ready for the International Bryological Congress that will be held at Missouri in July-August, 1989. A presentation of the lists there, and perhaps a working session to make further refinements, is planned. The Congress will be asked to pass a resolution endorsing the lists.

Flowering Plants and Ferns

A list of accepted generic names of non-fossil vasular plants compiled at the Royal Botanic Gardens, Kew, has been circulated to about 25 major institutions around the world for comment. Many helpful and constructive replies have been received which are currently being considered for incorporation. Publication of this list about the end of 1989 is anticipted, which will include a request for further comments prior to inclusion in the first combined draft for the IUBS/IAPT project. Correlation of this already computerized record with that of ING together with appropriate keyboarding and editing will then be required during 1990.

Fossil Plants and Spores

Two copies of the list of fossil plant genera from ING have been produced. This is a very important first step, but the need for a breakdown on stratigraphic grounds causes difficulty in passing lists out to palaeobotanists and palynologists for scrutiny.

The IAPT Committee on Fossil Plants are being asked to volunteer to participate in the exercise and the matter will be discussed by its Chairman and Secretary in April 1989. Coordination of this work as a part of the International Organization of Palaeobotany (IOP; IUBS Section of Palaeobotany)'s proposed new project for fossil names in all ranks, "The Fossil Plant Record", is envisaged.

Fungi (including lichen-forming fungi)

The data files containing generic names of fungi from the ING database have been successfully transferred on disc to computers at the CAB International Mycological Institute at Kew. The files have been compared by computer with the records for generic names in the seventh edition of the Dictionary of the Fungi (Hawksworth, Sutton and Ainsworth, 1983), where there is an indication as to whether the genus is accepted taxonomically or considered to be a taxonomic synonym, and the records in the ING file are so indicated accordingly. A series of

print-outs for each of the major taxonmic groups has been prepared and is now being considered by taxonomists at the CMI for comment and correction. Considerable correction of ING entries is required due to the change in starting point date adopted for the fungi in 1981. A list of specialists from a wide range of universities and institutions throughout the world, is being drawn up and appropriate printouts will be circulated to these persons in the summer of 1989. It is planned to have a consolidated draft available for debate at the Fourth International Mycological Congress (IMC 4) to be held in Regensburg, F.R.G. in Ausgust, 1990.

Leguminous Plants

This is being attempted as a trial for how species level work might progress. The International Legume Database Information Service (ILDIS) Board agreed at its meeting on 22 September, 1988, to participate in the IUBS/IAPT initiative. The project is now part way through the assembly of a high quality checklist of all the world's Leguminosae, planned as a 6 year programme from 1985-1991. The coordinating center at Southampton University now has data on 6,600 taxa from Europe and Africa and 9,000 taxa from North, Central and South America.

Aspergillus and Penicillium Species Names

A second trial species-level project is to be considered during the Second International Working Group on Aspergillus and Penicillium meeting in Baarn, the Netherlands, on 8-12 May, 1989. This workshop is being held under the auspices of the International Commission on the Taxonomy of Fungi (ICTF) of the International Union for Microbiological Societies (IUMS).

General Considerations

The International Commission on Zoological Nomenclature (ICZN) has been represented at the 1986 and 1988 meetings in Kew, and the initiative is being monitored by them. The report of the 1988 meeting was included in the Bulletin of Zoological Nomenclature (45:183-185, 1988).

In addition, CODATA decided to establish a Commission on the Terminology and Nomenclature of Biology as the result of an International Workshop held in Karlsruhe in September, 1988, to facilitate progress in this area. The preliminary document drawn up by the CODATA representatives and circulated on 10 March, 1989, discusses the IUBS/IAPT initiative noting that it "...could serve as a model for consideration by other subdisciplines wishing to embark on similar endeavours".

It is clear therefore that this development is being watched with considerable interest by the scientific community as a whole and it is to be hoped that IUBS and its supporting sponsoring countries and organizations will ensure that it is able to realize its objectives.

Acknowledgements

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References

BISBY, F.A., SUTTON, D.A., & RUSSELL, G.F. 1989. Taxonomic Databases Working Group for Plant Sciences (TDWG): Report of the Third Meeting at the Royal Botanic Gardens, Edinburgh, 19-21 October, 1987. Huntia : in press.

FARR, E.R., LEUSSINK, J.A. & STAFLEU, F.A. (eds.) 1979. Index Nominum Genericorum (Plantarum). 3 vols. (Regnum Vegetabile Nos. 100-102). 1896pp. Utrecht: Bohn, Scheltema & Holkema.

FARR, E.R., LEUSSINK, J.A. & ZILJLSTRA, G. 1986. Index Nominum Genericorum (Plantarum). Supplement I. (Regum Vegetabile Nos. 113.) 125pp. Utrecht: Bohn, Schetlema & Holkema.

FRIES, E.M. 1821-32. Systema Mycologicum. 3 vols. 520, 620 and 524pp. Lund & Greifswald: E. Mauritius.

GREUTER, W. 1986. Proposals on Registration of Plant Names, a New Concept for the Nomenclature of the Future. Taxon: 35:816-819.

GROLLE, R. 1983. Nomina Generica Hepaticarum: References, Types and Synonymies. Acta Botanica Fennica. 121:1-62.

HAWKSWORTH, D.L. 1988. Improved Stability for Biological Nomenclature. Nature. 334: 301.

HAWKSWORTH, D.L. & GREUTER, W. 1989. Report of the First Meeting of a Wroking Group on Lists of Names in Current Use. Taxon. 38: 142-148.

HAWKSWORTH, D.L., SUTTON, B.C. & AINSWORTH, G.C. 1983. Ainsworth & Bisby's Dictionary of the Fungi. Seventh Edition. 445pp. Kew: Commonwealth Mycological Institute.

INTERNATIONAL UNION OF BIOLOGICAL SCIENCES. 1985. Resolutions Adopted by the IUBS XXIInd General Assembly, 1-7 September, 1985, Budapest, Hungary. Biology International. 12: 12-16.

INTERNATIONAL UNION OF BIOLOGICAL SCIENCES. 1989. News Highlights from the 23rd IUBS General Assembly. Biology International. 18:15-17.

LINNEAUS, C. 1753. Species Plantarum. 2 vols. 1200pp. Stockholm: L. Salvius.

LINNEAUS, C. 1758. Systema Naturae. Tenth Edition. Vol. 1. 824pp. Stockholm.

PERSOON, C.H. 1801. Synopsis Methodica Fungorum. 706pp. Gottingen: Dieterich.

RIDE, W.D.L. & YOUNES, T. (eds.) 1986. Biological Nomenclature Today. (IUBS Monograph Series No.2) 70pp. Eynsham, Oxford: IRL Press.

SNEATH, P.H.A. 1986. IN: Biological Nomenclature Today (W.D.L. Ride & T. Younès, eds.): 36-48. ((IUBS Monograph Series No.2) Eynsham, Oxford: IRL Press.

Ecosystem Function of Biological Diversity

An IUBS/SCOPE Workshop*
held on 29-30 June , 1989, Washington D.C., USA.

Under the cosponsorship of IUBS and SCOPE, a small exploratory meeting on *"Ecosystem Function of Biological Diversity"*, was organized on 29-30 June, 1989, in Washington D.C., USA, in collaboration with the US National Committee for IUBS, and with financial support from the A.W. Mellon Foundation. Fifteen leading experts from France, Mexico, UK, USA and USSR participated at this meeting.

The IUBS interest in this topic stems from the adoption by the 23rd IUBS General Assembly, in 1988, of a proposal made by the US National Committee of IUBS, to launch an international cooperative research programme on *Biological Diversity*. The major goal of this program is to understand biological diversity in the context of the structure and function of ecosystems. On the other hand, SCOPE is engaged in an effort of synthesizing information on environmentally related issues involving species as well as whole ecosystems, and has a project on *"Criteria and Design for Long-Term Ecological Research"*.

Rationale

At the present time, the topic of biological diversity is receiving widespread attention in both the scientific and the popular press. Major interest and concern are expressed for the loss of biodiversity from the biosphere. Because of accelerating deforestation, particularly in tropical regions, there is a great sense of urgency in devising means to preserve species and natural ecosystems in threatened areas. The arguments that are utilized for species conservation are ethical as well as scientific. The latter include the importance of yet undiscovered species products (drugs of various kinds, for example), and the "services" provided by natural ecosystems (air and water quality, etc.). Unfortunately, many of the ecological arguments that are being made, although most likely correct, are built on a very limited data base. Some of the most fundamental assertions are subject to question. For example, rates of deforestation, which we are now able to document fairly precisely with satellite images, are equated with species extinctions. There is good reason to put forward this equation; however, few studies have documented the relationship between forest disruption of varying degrees with losses of species.

On the more ecological side, there is little hard evidence to make the linkage between species diversity and ecosystem function. Arguments have been made that species do not "count" in ecosystem function since there is so much redundancy in function among species. Thus the loss of diversity will not be evident in rates of processing of

* The final report of the workshop will be published in 1989, as a Special Issue of *Biology International*.

environmental resources. Others, however, give evidence to the overriding influence of certain species in controlling both the structure and functions of ecosystems (dominants and keystone species). There is obviously merit in both arguments for different systems. It is timely to show clearly under what situations one or the other of these possibilities prevail.

Other ecological issues related to the spatial and temporal dimension of diversity need clarification. The integrity and sustainability of ecosystems may be maintained in spite of species deletions up to a point, at which time there will be system degradation. This point may depend however, on prevailing environmental conditions. Episodic extreme events can perturb the ecosystem function with the capacity to resist such events perhaps dependent on system diversity. In addition, the ecosystem or landscape role of spatial diversity has not been systematically studied. On a continental scale, we are beginning to see major consequences in the functioning of systems that serve as seasonal hosts to migratory birds. On local scales, the ecosystem importance of hedgerows as reservoirs of diversity in agricultural systems is just now being quantified.

There is no question that not only is deforestation a threat to biotic diversity, but also so is the myriad of landscapes usage by human endeavors. We need a better understanding of the ecological significance of these changes, and we need it soon due to the accelerating rates of landscape modification.

Objectives

The main objectives of the workshop were to identify scientific issues that need international cooperation on both the role of biodiversity in ecosystem function (not to evolve a conservation strategy, but rather to bolster the scientific underpinnings for such a strategy), and to help answer the general questions on how can knowledge of species biology contribute to global ecology, and do species count in system functioning?

Within the framework of the above general objectives, the participants felt that it is essential to deal with biodiversity of plants, animals and microorganisms all together, at the level of terrestrial, fresh water and marine systems, and to address a certain number of very specific questions, as follows:

a- How good is our global database on losses or modifications of species, genetic material and ecosystems?

More specifically, how accurate are the estimates of species losses based on rates of deforestation?
What are the consequences of population genetic losses?
What is ourgrasp on the magnitude of the problem except for a few economically important species? and
Will remote sensing give us a complete inventory of ecosystem distribution and changes with functional accuracy?

b-What do we know about species losses and/or additions, and impairment of regional processes?
-How is loss of habitat influencing migrating organisms?
-How is habitat fragmentation influencing landscape transfer processes?
-What do we know about the relationship between genetic and species diversity and local ecosystem function? And specifically, how common are keystone species? How common is functional redundancy? Are species better indicators of system stress than system functional properties? What are the consequences of ecosytem simplification?

c-What role do species *versus* systems play in earth system functioning?
-Do dominants control major fluxes of gases, energy and chemicals?
-How will species *versus* ecosystems respond to global climate change? And what will be the consequences of rapid climate change on ecosystem integrity?

General Conclusions of Discussion

On the basis of the presentations and the discussions that followed, the meeting made the following general conclusions:

-Documenting species extinctions is **not** a useful scientific focus if this group is to fulfill its objectives; whereas documenting population and genetic losses due to habitat fragmentation, modification or consolidation is an important focal point.

-The limited evidence to date indicates that, to a certain level, biodiversity is **not** important in carbon, nutrient, and water balance, although it may be important in trace gas fluxes. The reason for this is internal redundancies and compensations.

The diversity of landscape biotic units, e.g., sucessional types, is important in landscape functioning. Therefore, there is a need to develop a world strategy for maintaining diverse landscapes. Also there is a need for more explicit experiments on the role of diversity and fragmentation on system functioning (merging systematic and ecological approaches).

-Species are more sensitive indicators of environmental change than are ecosystem functional properties, again due to internal compensations.

-Tracking species aggregation changes may help relativize system comparisons.

-Knowledge of biotic and functional diversity of microbial and marine systems is particulary weak.

-Systematics is becoming an endangered species !

-Scaling of species interactions and ecosystem and landscape functioning, as well as using comparative system approach, are areas that deserve further studies.

Possible Study Areas

Before identifying priority areas for possible and feasible studies, it is very important to underline a certain number of gaps and constraints that occur when studying the ecosystem function of biological diversity. The major gaps and constraints seem to be the lack of knowledge of numbers of species, of extinction rates, and the absence of relevent biogeography and systematics studies, as well as the alarming erosion of skills and scientific expertise that are necessary to proceed with systematic surveys and biological inventories. Also, the time dimension is very important, and the tasks to be achieved are very urgent.

Four major study areas were identified as follows:

1-The role of biotic and landscape diversity on functional properties and their response to change;
2-Global comparative biogeography
3-Long-term monitoring of biodiversity as an indicator of change; and
4-Conservation of genetic resources of wild species.

Participants

The convenors of the meeting were Profs. di Castri (France) and H. Mooney (U.S.A). The invited participants that were able to attend, were as follow: Profs. P. Lasserre (France), J. Sarukhan (Mexico), D.L. Hawksworth (U.K.), J.J. Ewel, J.F. Grassle, T. Lovejoy, J.J. Magnusson, G. Carlton Ray and D. E. Stone (USA), I.S. Reshetnikov (U.S.S.R), Ms. V. Plocq (SCOPE) and Dr. T. Younés (IUBS) .

PLANT BIOTECHNOLOGIES

New Prospects for Research and Biological Resources Development in the Arab Countries

An International Symposium organized by the Unesco/ICSU Biosciences Network in the Arab Region , 27-30 March, 1989, Amman, Jordan.

An international symposium on "*Modern Biotechnologies: New Prospects for Research and Biological Resources Development in the Arab Region*", was organized on 27-30 March, 1989, in Amman, Jordan, within the framework of the "First Arab Conference on Perspectives of Modern Biotechnologies in the Arab Countries". This conference was co-sponsorsed by the Higher Council of Science and Technology (HCST) in Jordan, The Federation of Arab Scientific Research Councils (FASRC), the UN Economic and Social Commission for Western Asia (ESCWA), and the ICSU/UNESCO Biosciences Network in the Arab Region (AraBN).

More than fifty participants from the Arab countries and a number of invited scientists from France, India, the Netherlands, U.K., and USA attended the meeting. Presentations included a number of review papers, research results and country reports.

A general review paper on "*Plant biotechnologies: present and future, especially for developing countries*" by A. Sasson (Morocco/Unesco), together with two survey documents, entitled "*Plant production and protection biotechnologies in the Near East and North African countries*", by I.Y. Hamdan (Kuwait), and "*Applied research in plant cell and tissue culture in the Arab countries*" by M.M. Abu El Nil (Saudi Arabia/USA), provided the background and basis for the general discussion.

Other sessions were devoted to research reports dealing with the various applications of plant tissue culture techniques, such as the production and micro-propagation of date palm (Iraq, Tunisia, and Saudi Arabia), citrus, strawberry and ornamentals (Egypt), and potato (Syria and Tunisia); the protection of date palm cultivars against 'Bayoud' disease, and the selection of drought tolerant strains of barley (Morocco).

Potentially promizing plant biotechnologies for the Arab countries were discussed, with special emphasis on the major agricultural crops and plant resources in the Arab region, in particular, date palm which represent 5% of the total arable land, citrus and olive trees which are grown in large areas in the Mediterranean region, and various kinds of vegetables and cereal crops.

The meeting also discussed the constraints facing the development of biotechnological applications in most Arab countries. They are mainly related to setting priorities and strategies, manpower availability and economic infrastructure and development. The nature of biotechnology as a multidisciplinary field adds to these constraints, because it requires integrating several disiplines of life sciences, necessitating a special training programme. These constraints include the following:

-absence of research and development priorities in the area of biotechnology.
-lack of appreciation by decision makers of the importance of biotechnological applications to plant production.

-inadequate funds allocated for research and development, in general, and biotechnology in particular.
-lack of undergraduate courses in biotechnology at most universities.
-lack of clear national plans and regional cooperation plans for developing biotechnology.

The meeting concluded that, at present, plant biotechnology applications in the Arab countries, are still limited to traditional and classical plant-breeding and production methods. A few countries established tissue culture laboratories, others are still in the process of preparing for the establishment of a plant biotechnology infrastructure. In spite of the gaps and constraints facing most Arab countries, the research activities intiated so far, represent an important starting point for the establishement of the infrastructure for biotechnology, and will have a long-term impact on the commercial development of agriculture.

ECOLOGY AND SOCIO-ECONOMY OF MOUNT KENYA

An IUBS/UNESCO-MAB Workshop
Nanyuki, Kenya, 5-12 March, 1989.

An international workshop, entitled *"Ecology and Scocio-economy of Mount Kenya Area"*, took place on 5-12 March, 1989, in Nanyuki, Kenya. The meeting was organized by the University of Berne, Switzerland, and the University of Nairobi, Kenya; under the co-sponsorship of the IUBS' Decade of the Tropics and the Unesco MAB Programmes, and in collaboration with the Swiss Development Cooperation (SDC)Agency.

The major aim of the workshop was to discuss the development of an *integrated research programme on the ecology and socio-economy of Mount Kenya.* This mountain provides an ideal model of a tropical high mountain system which, taken as a whole, represents an ecological island within the broad East African semi-arid region.

Despite the fact that there is a wide range of available research results, there are several reasons for initiating a new programme in order to develop a coordinated and more holistic approach to this tropical mountain system. There is a need to gain a more complete (and not predominantely sectorial) data set of Mount Kenya for model studies and for the elaboration of key processes. Also, there are significant environmental changes that have occured within the last two decades, and resulted in changes of the ecological system. These changes have natural and human-induced causes: on one side, there is a strong evidence for significant climatic changes and fluctuations; on the other, and maybe far more important, change is due to human impact on the lower parts of Mount Kenya and the surrounding lowlands.

The proposed programme will include the establishement of *transect studies, ecosytem research,* and the study of *interrelations between human and natural systems.* Also, the programme will explore several key processes associated with mountain systems, such as *migration, marginality, deforestation,* and *soil loss.* A Programme Committee and a PLan of Action were established.

For more information, please contact Prof. Mathias Winiger, Institute of Geography, University of Bonn, Meckenheimer Allee 166, D-5300 Bonn 1, FRG.

FINANCIAL STATEMENT OF IUBS FOR THE YEAR 1988

STATEMENT 1. Balance sheet at December 31, 1988 (Expressed in US$)

ASSETS: Cash and Banks		
Paris, in US$	10715	
Frankfurt/Main, in US$	0	
Paris, in FF	1974	
Paris, in US* (Deposit Account)	500000	512689
Crédit Chimique		
in FF	783	
in US$	20100	20883
Other Assets		
Other Receivables	18788	
Transfer from CB Frankfurt, to C.C.Paris	773	19561
Loans (note 7)		
		553133
LESS: Liabilities		
Sundry creditors	10212	10212
Excess of assets over liabilities		**542921**
Represented by		
Accumulated Fund		***542921***

STATEMENT 2. Income and expenditure for the year ended December 31, 1988 (Expressed in US dollars)

1. INCOME		
ICSU Subventions	35432	
Special subventions from Int'l Org. (Unesco CEC, etc.).	88637	
Contributions from National Members	201986	
Interests and dividends	38153	
Gain or loss over exchange	2320	
Other income	27888	
Total Income		**394416**
2. EXPENDITURE		
Business Meetings		
General Assembly and Executive Com. Meetgs.	41881	
Officers Meetings & Travel	10934	52815
Publications	6981	6981
Scientific Programmes & Activities		
Grants to IUBS Scientific Programmes	243870	
Subventions to Scientific Congresses	17547	
Representation at Scientific Meetings	5620	
Contribution to Other Organizations	6360	273397
Administrative Expenses		
Salaries	64845	
Related Charges	49480	
General Office Expenses	32998	147323
Other		
Bank charges	290	
Audit fees	3525	
Miscellaneous	274	4089
Total Expenditure		**484605**
Total Income		**394416**
Excess of income over expenditure		**-90189**
Accumulated balance brought forward		***633110***
Accumulated balance carried forward		***542921***

IUBS LOANS TO INTERNATIONAL SCIENTIFIC CONGRESSES FOR THE PERIOD 1989-90

1)20th International Ornithological Congress December , 2-9, 1990 Christchurch, New Zealand	5000$
2)6th Meeting of the Organisation for the Phyto-Taxonomic Investigation of Mediterranean Areas (OPTIMA) September 10-16, 1989 Dhelfi, Greece	6000$
3)ICSEB IV-The Unity of Biology July 1-7, 1990 University of Maryland , College Park, USA	5000$
4)2nd International Congress on Nematology August 11-17, 1990 Eindhoven, The Netherlands	5000$
5)15th Conference of European Comparative Endicronology September 9-14, 1990 Leuven, Belgium	5000$
6)4th International Mycological Congress August 28-September 3, 1990 Regensburg, F.R.G	5000$
7)International Symposium on Designs for a Global Plant Informaton System Organized by TDWG Plant Taxonomy Data Bases	5000$
8)8th International Palynological Congress September 6-12, 1992, Aix-en-Provence, France	5000$
9)4th INtertnational Congress on Aerobiology August 27-31, 1990, Stockholm, Sweden	5000$
10)6th International Congress on Spermatozoa August 30- September 4, 1990 Siena, Italy	5000$
Total Loans in US$	**51000$**

PUBLICATIONS REVIEW

ISLANDS, ISLANDERS AND THE WORLD

Edited by T. Bayliss-Smith, R. Bedford, H. Brookfield & M. Latham
Published by Cambridge University Press, 1988 (323 pages)

This book is authored by the key research workers in the Unesco MAB project on population/environment in Eastern Fiji for which the field work was carried out from 1974 to 1976. The authors examine the environmental, social and economic aspects of this experiment at scales ranging from national and regional to island, village and household. Some important lessons are to be learned from the gap between what might be predicted from abstract theories of development and what is actually happening in the real world of politicians, planners, farmers and fishermen.

FUNGI IN BIOLOGICAL CONTROL SYSTEMS

Edited by M.N. Burge
Published by Manchester University Press, 1988 (209 pages)

This textbook outlines the current problems and progress of research to develop fungi as agents of biological control of glasshouse and agricultural insects, weeds and plant pathogens (including eelworms). The contributors are active workers in the U.K., the U.S.A. and Australia.

A REVOLUTION IN BIOTECHNOLOGY

Edited by J.L. Marx
Published for ICSU Press by Cambridge University Press, 1989 (227 pages).

This reference book is the first of a series for the general readers sponsored by ICSU. It consists of 16 chapters dealing with the various aspects of modern biotechnology, illuminating the scientific background, describing what has already been achieved, and discussing ethical problems.

ADVANCES IN GENE TECHNOLOGY: PROTEIN ENGINEERING & PRODUCTION

Edited by K. Brew *et al*
ICSU Short Report Series published by IRL Press.

This volume represents the proceedings of the 1988 Miami Bio/Technology Winter Symposium. It contains over 170 reports on topics of current research and development in the area of protein engineering and production. This book

should serve as an introduction to the field for scientists from various other disciplines.

EFFECTS OF ATMOSPHERIC AND CLIMATE CHANGE ON TERRESTRIAL ECOSYSTEMS

Report n° 5 of IGBP/ Global Change Series, published by ICSU, 1989 (61 pages).

This report presents the findings of the workshop held in Canberra, Australia, 28 Feb.-2 March, 1988, on the first topic of the IGBP Programme related to «terrestrial biosphere-atmosphere chemistry interactions». The overall objective of the workshop was to develop a research program which will generate a predictive understanding of the effects of climate change on terrestrial ecosystems, where climate change includes changes in both climate and atmospheric composition.

HEALTH POLICY, ETHICS AND HUMAN VALUES

Edited by Z. Bankowski and J.H. Bryant
Published by CIOMS, Geneva, 1988 (223 pages).

This volume contains the highlights, papers and conclusions of the conference «Health Policy, Ethics and Human Values- An International Dialogue», organized by CIOMS in cooperation with WHO in November, 1984, in Athens, Greece. The main topics of the conference were screeening and counselling, organ transplantation, the elderly, and lifestyles and health hazards.

PROCEEDINGS OF THE XIV INTERNATIONAL BOTANICAL CONGRESS

Edited by W. Greuter and B. Zimmer
Published by Koeltz Scientific Books, Köngstein, 1988 (479 pages)

This volume represents the final document of the XIV International Botanical Congress, held in Berlin, FRG, 24 July- 1 August, 1987. It includes two parts, the first consisting of the proceedings proper, and the second comprizing the full text of the General Congress Lectures.

TIME SCALES AND WATER STRESS: Proceedings of the 5th

Edited by F. di Castri, Ch. Floret, S. Rambal and J. Roy.
Published by IUBS, Paris, 1989 (678 pages).

This volume includes most of the presentations to the Vth conference on Mediterranean Ecosystems (MEDECOS V), held on 15-21 July,1987, in Montpellier, France. Ninety nine articles are included in five main sections: paleoecological aspects, daily response, seasonal response, interannual variability, and evolutionary aspects.

IUBS

RECENT PUBLICATIONS

BIOLOGY INTERNATIONAL

Special Issues

N° 12- Comparative Studies on Tropical Mountain Ecosystems: Planning for research, by M.Monasterio, G. Sarmiento & O.T. Solbrig. 1987 (US$ 5)
N°13-Tropical Soil Biology and Fertility: Inter-regional Research Planning Workshop, by M.J. Swift, 1987 (US$ 5)
N°14-Processus Biologiques des Sols Tropicaux (TSBF-French Version), by M.J. Swift & P. Lavelle. 1987 (US* 5)
N°15-Biology and Complexity: Some Physical Facets, by G.Careri and G. Nicolis, 1987 (US$5)
N°16-Geosphere-Biosphere Observatories: Their Definition and Design for Studying Global Change, by M. J. Dyer, F. di Castri and A.J. Hansen. 1988 (US$5)
N°17-A New Look at Ecotones: Emerging InternationalProjects on Landscape Boundaries, by F. di Castri, A.J. Hansen and M.M. Holland. 1988 (US$15)
N°18-Rain Forest Regenration and Management, by M.Hadley. 1988 (US$10)
N°19-Diversity of Tropical Species: Questions That Elude Answers, by A. Lugo. 1988 (US$10)

IUBS MONOGRAPH SERIES

N°1- Biological Monitoring of the State of the Environment: Bioindicators, by J. Salanki, 1986 (UK£ 12)*
N°2- Biological Nomenclature Today, by W.D.L. Ride and T. Younés. 1986 (UK£ 10)*
N°3- Determinants of Tropical Savannas, by B. Walker. 1987 (UK£ 12)*
N°4- New Challenges for Biological Education, by G. Schaefer and T. Younés, 1986 (Published as a Special Issue of *Biology International*- US$5)
N°5- Computers and Biological Education: The Expanding Universe, by T. Crovello. 1988 (US$25)
* Orders to be placed with the Publisher *IRL Press Ltd., Eynsham, Oxford,* OXB 1JJ, UK

IUBS METHODOLOGY SERIES

N°1- Research Procedure and Experimental Design for Savanna Ecology and Management, by B.H. Walker and J-C. Menaut. 1988 (US$20)
N°2- Manual of Methods for Mountain Transect Studies, by T. van der Hammen, D. Mueller-Dombois and M. Little. 1989 (US$20)
N°3- TSBF- A Handbook of Methods, by J.M. Anderson and J.S.I. Ingram, 1989 (Published by C.A.B.InterantionalWallingford, Oxon OX10 8DE, UK)
N°4- Handbook of Methods for the Measurement of Working Capacity, Physical Fitness and Energy Expenditure in Tropical Poulations, by K.J. Collins . in Press (US$ 25)

PROCEEDINGS

Time Scales and Water Stress: Proceedings of the 5th Int'l Conf. on Mediterranean Ecosystems, by F. di Castri, Ch. Floret, S. Rambal, J. Roy, 1989 (US$ 25)
Proceedings of the 23rd IUBS GENERAL ASSEMBLY, Canberra, Australia. 1989 (US$10)

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