THE GLOBAL ENVIRONMENT MONITORING SYSTEM

GEMS
INFORMATION SERIES
NO. 7

NAIROBI
JUNE 1988

A Report on the Conservation Monitoring Centre: Data Holdings and Data Management

D NATIONS ENVIRONMENT PROGRAMME

This report was prepared by Mitchell E. Loeb, Consultant to GEMS/PAC, Nairobi. The information included herein was derived from published and unpublished materials (see References) and from direct interviews with staff members of the IUCN-CMC. The views expressed are those of the author and do not necessarily reflect the views or opinions of either UNEP or GEMS.

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UNITED NATIONS ENVIRONMENT PROGRAMME

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Duncan Mackinder (CSU)
Nick Phillips (CSU)
absent - Robin Pellew (Director)

pm - Protected Areas Data Unit
Jerry Harrison
Michael Green
Zbigniew Karpowicz

December 8th am - Wildlife Trade Monitoring Unit
Jonathan Bardzo
Steven Broad
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Richard Luxmoore

pm - Species Conservation Monitoring Unit
Brian Groombridge
Martin Jenkins

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Vernon Heywood
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ACRONYM LIST

IUCN	International Union for Conservation of Nature and Natural Resources
CMC	Conservation Monitoring Centre
PADU	Protected Areas Data Unit
SCMU	Species Conservation Monitoring Unit
WTMU	Wildlife Trade Monitoring Unit
TPU	Threatened Plants Unit
CSU	Computer Services Unit
CNPPA	Commission on National Parks and Protected Areas
SSC	Species Survival Commission
UNEP	United Nations Environment Programme
GEMS	Global Environment Monitoring System
GRID	Global Resource Information Database
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WWF	World Wildlife Fund

INTRODUCTION

The CMC was established by the IUCN in 1982 to act as a provider of information on global conservation. This was to be accomplished by developing a central database with a global coverage of the status of living natural resources. Ideally the information held by the CMC would be provided to planning and programming divisions of the IUCN and the WWF plus GEMS (UNEP) - the three major sponsors of the CMC, as well as governments, non-governmental organisations, the business, commercial, scientific and educational communities and the media among others.

As outlined in its glossy information pamphlet, the role of the CMC is

"...the continuous collection, analysis, interpretation (author's underscoring) and dissemination of data as a basis for conservation. Species, habitats and areas of relevant conservation concern include those having current or potential economic importance and those believed to be under threat.

" CMC undertakes its function by integrating 4 monitoring activities which cover the status of : Animal Species (SCMU)
Plant Species (TPU)
Wildlife Trade (WTMU) and
Protected Areas (PADU).

" Data resulting from these activities are linked by common geographical and taxonomic coding systems within the computer. The result is a highly sophisticated database capable of producing integrated outputs on a wide range of contemporary conservation issues.

" CMC disseminates this information through a series of publications, including the renowned Red Data Books on plants and animals, and by providing special reports tailored to the needs of clients."

That the CMC has not been able to achieve these goals is now well documented. A brief review of recent history will help to clarify the situation.

The CMC controls a massive amount of conservation information and has had, from its inception, the potential to become the leading centre for conservation monitoring data worldwide. Unfortunately, the Centre never received the administrative, logistic or financial support from the IUCN that it needed to attain this leadership role, let alone to maintain current standards of operation. This caused the CMC to shift dramatically from its originally established mandate. Due directly to conditions of underfunding the CMC was forced to rely on short-term contract work in order to make ends meet. Consequently, the role of the CMC in global conservation monitoring and assessment has slowly declined. Along with this gradual deterioration in programme relevance has been the CMC's inability to maintain and develop its databases. The situation further deteriorated in 1986 when UNEP withdrew its financial support due to the CMC's failure to a) respond to the information needs of UNEP and b) acknowledge, in it's publications, the support it received from UNEP (cf. CMC's information pamphlet).

BRIEF DESCRIPTION OF THE IUCN-CMC COMPUTER SYSTEM

(D. Mackinder - CSU)

KEW

1. Wang VS65 with 2Mb main memory, 800 Megabytes (2 x 288 Mb drives and 3 x 75Mb drives) disk storage and a Wang 5 1/4 inch floppy disk drive. Peripheral devices supported are 10 x video workstations, a matrix printer, a high quality daisy wheel printer and a HP Laserjet printer. Software supported includes Wang Word-Processing and database software written in-house, mainly in COBOL.

2. DEC MicroVAX II with 16 Mb main memory, 456Mb disk storage (RA81 fixed disk), a TK50 cartridge tape drive (tape capacity 95Mb), a TSV05 industry standard magnetic tape drive (9-track, 1600bpi phase encoded), 8 serial lines for terminals and printers, the DEQNA DEC Ethernet (LAN) interface, and one KMV1A communications controller. Peripheral devices supported are 4 x VT220 video terminals, an LA100 printing terminal (system console), an LA210 matrix printer, an LN03 laser printer. The operating system is MicroVMS (Version 4.6). Database maintenance is via DEC VAXInfo-I information management package (VAX-Rdb being the relational database management system); DEC VAX-Set is the programme development environment; programming languages COBOL and C are supported, as are DECNet and VAX-PSI communications software.

3. IBM-PC AT with 640k main memory, extended keyboard, EGA, colour monitor, 30mb hard disk, plus 360Kb/1.2Mb dual density and 360Kb 5 1/4 inch floppy disk drives; an Epson FX1000 matrix printer. Software supported includes dBase III+, Uniform-PC. Amstrand PCW 3 inch disk drive.

Cambridge

4. Wang OIS 115-2 with an 8Mb fixed disk drive, linked to the Kew VS by a remote WangNet telecommunications link via a dedicated circuit. The OIS has a Wang 8 inch floppy disk drive, 13 video workstations, a daisy wheel printer and a font-loadable matrix printer.

5. 2 Wang PCs with 256k main memory, one with one 5 1/4 inch floppy and one 10Mb Winchester hard disk, the other with two 5 1/4 inch floppy disk drives. Both are capable of archiving workstation emulation and support the MS-DOS operating system.

IUCN-CMC DATA EXCHANGE TECHNIQUES
(D. Mackinder - CSU)

1. Magnetic Tape: This is currently the best way of transferring extensive data files between computer systems. Tape should be 9-track, 1600bpi, phase-encoded (800 bpi tapes are also acceptable). Ideally, the tape should be in the VAX/VMS BACKUP format. For transfers involving non-VAX systems, the tape should preferably be unlabelled (but ANSI or IBM labels can usually be read), records must not span blocks and preferably should be of fixed length. The block size must be a multiple of the record length and must not exceed 32Kb. If possible, a printout of the first few blocks (including the labels, if present) should be included. For tapes not produced to these specifications, translations may be possible, but these would be time consuming.

2. DEC TK50 Cartridge Tapes: A convenient means of data transfer with other DEC systems that support the TK50 cartridge drive. Cartridges hold up to 95 Mb of data, and are light and easy to post.

3. Telecommunications: CMC can handle 1200/2400 baud synchronous communications over the public switched telephone network. Modems must be compatible with CCITT V26 standard. Acceptable protocols include IBM 2780 and IBM 3780. Wang word-processing documents may be transferred from other Wang systems using Wang WPS protocol which is an extension of IBM 2780. In the near future, it is hoped that asynchronous and X.25 communications will be supported.

4. 8 inch Wang format floppy disks: All Wang WP systems (except the 'Wangwriter'), can exchange word-processing documents on the standard Wang 8 inch archive disks. VS 8 inch diskettes cannot be read.

5. 5 1/4 inch MS-DOS or Wang format floppy disks: MS-DOS files can be transferred using either 360Kb or 1.2Mb density format disks - via the IBM-PC or Wang PCs (360Kb disks only). Data should be transferred in the form of MS-DOS ASCII text files (ie files that display intelligibly via the MS-DOS command TYPE) or dBase III data (.DBF) files, but other format files may be possible. Additionally, the Wang PCs can read and write disks in Wang word- processing archive format, such as those used on Wang VS, OIS and Wangwriter systems. Wang PC word-processing documents differ in format from other Wang WP documents, but can be treated as MS-DOS files, and transferred via MS-DOS format disks. Wang VS format 5 1/4 inch diskettes can also be read and written.

6. 3 1/2 inch MS-DOS format floppy disks: IUCN-CMC has access to a PC which can read and write these in addition to 5 1/4 inch MS-DOS format disks.

7. Other format 5 1/4 inch floppy disks: CMC has the ability to read and write ASCII text files to and from soft-sectored 8-bit or 16-bit CP/M format 5 1/4 inch disks, using the Uniform-PC software which

supports several different manufacturers' formats. Additionally CMC can exchange data on either Acorn format 5 1/4 inch disks or Torch CP/M 5 1/4 inch disks. Disks may be either single or double density, and single or double sided.

8. Amstrad PCW 3 inch floppy disks: CMC has the ability to read and write ASCII text files to and from the 3 inch disks used by the Amstrad PCW word-processor. Note that LocoScript files themselves cannot be read/written, LocoScript must be used to convert these to/from ASCII first/afterwards.

DATA HELD BY THE CMC - AN OVERVIEW

Each of the four conservation monitoring units holds data in three forms: on paper or in the computer as database files or word-processing documents.

Database files have a predefined structure consisting of fixed-length fields holding specified data. The data can, in principle, be easily manipulated, for example, sorted or retrieved by user-defined criteria (all national parks over 10000 hectares in area); and summed or counted (the number of records of vulnerable plants in Thailand). Essentially data handling is input-output oriented, with little or no emphasis placed on assessment, analysis, interpretation, or integration.

Word-processing documents hold textual information in paragraphs with predefined titles, eg 'Land tenure' or 'Scientific research and facilities'. The paragraphs can be of variable length. According to the report of Rudischhauser and Game, word-processing documents are flexible, easy to edit and display. MacKinnon, in his report, came to a different conclusion; claiming that the text documents are very laborious to up-date or correct, and that they are rife with errors. It is possible to extract specific paragraphs from the documents, however they are not easily interrogated. Searches are slow and limited to a single string of characters, eg all threatened plant documents containing the name Cypripedium calceolus.

Paper files contain, among other unit-specific items, reference materials, books and reports, correspondence and the addresses of contacts. No integrated bibliographic or address system exists to handle the large amount of information contained in these files.

In addition to unit-specific databases, the CMC maintains two types of general databases: area look-up files and species look-up tables.

Area look-up files: These contain basic data about 600 geographic units into which the world has been divided. Areas vary in size from single islands to 'pantropics'. The data held are:

- area name
- CMC code, two-letter ISO code and a code for the area concerned allocated by CMC based on countries represented at the UN
- size of area and population.

Animal species look-up table: This is used to translate the CMC species codes according to family, order, class and phyllum. A corresponding look-up table is used for threatened plant species.

PROTECTED AREAS DATA UNIT

The IUCN-CMC Protected Areas Data Unit (PADU) works closely with the IUCN Commission on National Parks and Protected Areas (CNPPA). A direct computer link has been established between PADU and the US National Parks Service. The database includes information on protected areas larger than 1000 hectares (100 ha for islands) which are protected primarily for nature conservation by the 'highest competent authority' in the land.

Data in the database:

Name of protected area
Country it lies within - this links with the IUCN-CMC areas database
Size
Year of establishment
Management category (Annex 1)
Definition within the country
Biogeographic code (Annex 2)
Latitude/longitude (central coordinates for smaller protected areas, and corner coordinates for larger areas - see map Annex 3)
Altitude
Text file identification
Type(s) of maps PADU has on file (not yet fully implemented)
If PADU has a management plan on file (not yet fully implemented)
Fields for use in data management - eg last update, unique site number etc.

To date there are records for approximately 12000 protected areas in the database.

One record exists for each protected area. Duplication exists, however, when a particular area is designated under more than 1 management category (eg national park and biosphere reserve). In such circumstances, 2 records will appear in the database. The 2 designations may not be altogether identical since the biosphere

reserve may be larger or smaller than the national park or may overlap it.

The information in the database is handled in a limited number of ways; data items can be selected and sorted using any character or group of characters within the data file. It is possible, for example, to obtain a list of protected areas of over 100000 hectares within the Tropical Humid Forest biome in Latin America, a list of sites in Burma and Thailand in IUCN management category I, or a list of all protected areas established between 1954 and 1972. By sorting the data, it is relatively straightforward to put together volumes like the United Nations List of National Parks and Protected Areas.

Data held in text files:

Data on individual countries are presented in the form of 'country information sheets' which contain the following data fields: country, area, population, parks and reserves legislation, parks and reserves administration and management, addresses, additional information, references and protected areas list. Data on individual areas are presented in the form of 'information sheets' where information is grouped under the following standard headings:

Country
Name
Management category
Biogeographical province
Geographical location
Date/history of establishment
Area
Land tenure
Altitude
Physical features
Climate
Vegetation
Fauna
Cultural Heritage
Local human population
Visitors/visitor facilities
Sci. research & facilities
Conservation management
Management problems
Staff
Budget
Local administration
References

Approximately 4500 protected areas are documented in this way.

The information in these text files is checked as time allows and added to, using material from various sources; through, for example, correspondence, literature research, or PADU's network of professional contacts. A more systematic review of the sheets from any given region is carried out prior to and at CNPPA regional meetings, and draft material is sent to the appropriate experts for comment. These information sheets are published in the form of protected areas directories, such as The IUCN Directory of Indomalayan Protected Areas (IUCN, (1987).

Data held in paper files:

The paper files currently extend to eight filing cabinets and more than 35 metres of shelving. Included are:

- management plans and other detailed information on individual protected areas
- information on protected area systems, addresses of government offices
- books, reports, correspondence, references
- project proposals
- lists of other protected areas not included in the database.

Also housed at the CMC are the official documentation for Ramsar and World Heritage sites as well as the scientific documentation on the Biosphere network for UNESCO.

Needs:

The following points were mentioned as needs of the PADU:

- long-term planning
- habitat coding system
- integration with animal/plant databases
- documentation written for the database
- data manager/systems analyst in unit
- integration of computer mapping and map handling routines.

SPECIES CONSERVATION MONITORING UNIT

Data in the database:

Higher taxonomic names (Family and above)

Taxon name (genus and below)
ISIS code (International Species Inventory System)
Authority for taxon name
If taxonomy disputed
Common name
Codes for references relating to the taxon
Basic habitat (eg marine, terrestrial) - used for molluscs only. It is intended that this basic coding system be replaced when IUCN-CMC is able to devise/adopt a more sophisticated system for all databases.
World IUCN Category-IUCN status category code - extinct, endangered, vulnerable, rare, out of danger, indeterminant, insufficiently known, neither rare nor threatened, no information - some compound categories are also permitted
When last seen (extinct or nearly extinct taxa only)
Wild population size
Wild population trend

Captivity status
Captive population size
Exploitation by man
Threats to taxon
Text file identification
Fields for use in data management
CITES data
CITES Appendix
Status of distribution information (ie how complete)

Country/states in which taxa occur - links with the IUCN-CMC area database

For each area/taxon combination:
Record quality
Area IUCN Category (same as World IUCN Category)
On local endangered species list
Use of area (migratory species only)
Occurrence in reserves/protected areas
Introduction status (native, introduced, re-introduced)
Area population size
Area population trend
Legal coverage area
CITES Appendix III data
Geographical qualifier - specification of distribution within country/state

SCMU holds data on over 18000 taxa, although not all information is available for all taxa. Almost 600 areas are referenced and there are over 68000 area/taxon combinations.

Data are held in two computer files. The first consists of 1 record per taxon, the second consists of 1 record per area/taxon combination.

Data in the text files:

Data on individual species are compiled into an 'information sheet' where information is grouped under the following standard headings:

Vernacular name	Population
Scientific name	Habitat and ecology
Authority for name	Threats
Order	Conservation measures
Family	Captive breeding
World IUCN Category	Remarks
Summary	References
Distribution	

Groups of related information sheets have been published in the form of Red Data Books, such as Threatened Swallowtail Butterflies of the World (Collins and Morris, (1985). Approximately 2500 animal taxa are included in these detailed Red Data Book accounts.

SCMU also maintains data sheets on Coral Reefs, including national summaries. These are published by UNEP/IUCN: Directory of Coral Reefs of International Importance, Vol 1. Atlantic and Eastern Pacific (UNEP/IUCN). The following standard headings are used:

Name of reef	Scientific importance and research
Geographical location	Economic value and social benefits
Area, depth, altitude	Distribution or deficiencies
Land tenure	Legal protection
Physical features	Management
Reef structure and corals	Recommendations
Noteworthy flora and fauna	References

Data in paper files:

These include:

- names of contacts and references to projects arranged by species and country (several 1000 index cards)
- circa 20000 references to articles, papers, press releases etc on cards indexed by species
- books and reports
- files containing letters, brief reports and notes on species or species groups
- information on coral reefs, arranged by country

Needs:

The needs expressed by the staff of the SCMU are listed below:

- database redesigned into a package operational on a pc (with documentation)
- ability to send customised package to, for example, SSC groups/countries so they can input their own data (ie National database input)
- access to terminals (at present staff must book computer time in advance)
- database manager/systems analyst for the animal database
- Taxonomic steering committee to set taxonomic standards
- Habitat coding steering committee to set habitat coding standards
- staff paid to input data
- effective bibliographic system
- address database capable of sorting by species/country/region
- graphics software package
- GIS
- long-term planning
- coordination among Units

THREATENED PLANTS UNIT

Data held in the database:

At present there are three integrated databases which focus on: threatened plants, national plant Red Data Books and plants of conservation concern in cultivation in botanic gardens. The databases are linked to a bibliographic database that contains conventional references, plus data sources which may be linked to individual data items (such as plant distribution records).

The databases use a common taxonomic skeleton:

- **Family**
- **Genus**
- **Species (plus authority)**
- **Lower taxon (plus authority)**

43301 plant taxa are held by the TPU.

For each threatened plant (17926 plants are recorded as threatened worldwide):

- **World IUCN Category (same as for SCMU)**
- **Endemism code**
- **Text file identification**
- **Listed/proposed under US Endangered Species Act**
- **Life-form**
- **Status of distribution information (ie how complete)**
- **Country/states in which taxa occur - links with the IUCN-CMC areas database**
  - **For each area/taxon combination:**
    - **Area IUCN Category**
    - **Regional IUCN Category**
    - **Occurrence status**
    - **Geographical qualifier - specification of distribution within country/state**

There are over 52000 area/taxon combinations in the database.

For each plant Red Data Book

- **Full citation**
- **Area covered**
- **Language(s)**
- **Information content per taxon (eg distribution, threats, protected areas, maps, illustrations)**
- **List of taxa, including details of conservation status, occurrence, endemism and origin.**

Since the system was started in early 1986, 67 Red Data Books have been included in the database, covering 17044 records of 12012 plant names. This represents:

- all recent Red Data Books for European countries
- TPU survey reports for those European countries that have not prepared Red Data Books (Italy still to finish)
- recent lists for South Africa
- the latest USF&WS list for the United States (1985), held in electronic form but not yet fully incorporated and not included in the figures above.

For each plant in cultivation in botanic gardens:

Gardens in which it is known to be cultivated
For each garden/plant combination:
Source of plant material (eg wild, cultivated, unknown)
Existence of duplicates

This database includes 22366 records for 4967 of the known threatened taxa recorded in the collections of 250 major botanic gardens.

For each botanic garden:

Contact information

Information is held on approximately 1500 botanic gardens used for mailing the Threatened Plants Newsletter.

Data held in text files:

a) Data on approximately 550 individual threatened species are compiled into 'information sheets' where information is grouped under standard headings similar to the animal information sheets. The first 250 of these sheets are found in The IUCN Plant Red Data Book (1978).

b) Data on the status of plant conservation in each country in the world. The information is grouped under the following standard headings:

Country name	Information on threatened plants
Size	Laws protecting plants
Population	Voluntary organisations
Floristics	Botanic gardens
Vegetation	Useful addresses
Checklists and floras	Additional references
Field-guides	

c) Data on plant-rich areas and vegetations types considered to be of top priority for conservation.

Periodically, groups of related information sheets are assembled and published, in a form such as: Plants in Danger: What do we Know? (IUCN, 1986), or the Threatened Plants Newsletter.

Data held in paper files:

Included are:

- Manual record cards on 50000-80000 plant species containing data, with sources, for the computer files
- correspondence
- books and reports.

Needs:

- integration with PADU -
  - the ability to record plants in protected areas within the TPU datafile
  - maintenance of data on protected area plant lists
- integration of WTMU and TPU datafiles on plants and the development of a list of CITES plants
- a habitat coding scheme
- a scheme for coding the degree of threats to plant existence
- life-form coding - a simple system is required, eg T=tree S=shrub
- a code for population trends, eg D=declining S=static I=increasing
- to extend the occurrence field into the CMC codes for Existence, Occurrence and Endemism as outlined in the Plant Existence Categorisation Scheme (Draft)
- acquisition of GIS and training of staff in its use

WILDLIFE TRADE MONITORING UNIT

The IUCN-CMC Wildlife Trade Monitoring Unit (WTMU) is responsible for managing information on trade in endangered species and products thereof, and information on wildlife utilisation. WTMU works closely with the Secretariat of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, and with a number of CITES management authorities.

Data held in the database:

The main computer databases held by WTMU record shipments of wildlife and wildlife products in trade, and are used as a basis for reports and analyses. These shipment data include information on

taxon, importing country, exporting country, country of origin, type of goods, quantity, etc. Analytical reports produced include reported trade in individual taxa/groups of taxa, comparisons of reported imports and exports, etc. Outputs include comparative tabulations, estimates of gross/net trade and annual reports. WTMU also maintains a database on the trade in ivory. This enables the trading of individual tusks to be monitored.

Records of over 600000 trade transactions are held by the WTMU. In addition the ivory database has approximately 160000 records.

Data held in text files:

Data on numerous aspects of wildlife trade are compiled into reports and information sheets. These include accounts of trade in individual taxa/group of taxa, and accounts of particular types of trade, drawing on customs data as well as CITES data.

Data on wildlife utilisation activities, such as crocodile farming, are compiled into information sheets.

Information is regularly published in Traffic Bulletin (ISSN 0267-4297), and periodically in the form of books, such as A Directory of Crocodilian Farming Operations (Luxmoore et at. 1985).

Data held in paper files:

- published and unpublished material and special reports on trade or exploitation by species and higher taxa (also organised by country or region)
- card index of data extracted from the UK import license applications for animals (3500). These are confidential and subject to the UK Official Secrets Act.
- records containing published customs data from a large number of countries relating to wildlife trade
- a paper file on wildlife legislation in over 150 countries
- an index system (over 2000 cards) with information on dealers in wildlife or wildlife products
- for birds, a separate file is maintained for the highest price each year at which each species is offered in the UK
- information on wildlife farming organised by species and country (crocodile and deer farming)
- some information is held on extensive wildlife utilisation.

Needs:

The needs stated by members of the WTMU included; a graphics software package, the desire to calculate trends in trade and to expand the programme to include the monitoring of non-CITES species.

COMMENTS, IMPRESSIONS, RECOMMENDATIONS

A Foreword.

From the onset of this mission, I had to keep in mind that the financial, personnel and logistic restraints placed on the CMC came not from within but from without. All of the staff members that I spoke with expressed the same frustrations with respect to a lack of adequate operating funds, a lack of skilled personnel to carry out even routine duties, and cramped working quarters. While realising the problems facing the CMC and its individual units, I believe that the staff felt the helplessness of those who must trust others with decisions regarding their future.

All comments, impressions and recommendations below should be qualified by the above statement.

1. Since the Director was unavailable (through no fault of his own) for the duration of my mission, I was, unfortunately left with the impression that the CMC functions without direction. While this may seem an unfair statement, other observations supported my initial impression. Each of the four conservation monitoring units functions quite independently, with little apparent knowledge of the modus operandi of the other units. Even the CSU, which should coordinate the CMC's computer activities, functions on its own and deals with the other units as separate entities, not as part of an integrated whole. The needs expressed for greater integration within CMC and for long-term planning, only emphasise the lack of an effective management strategy. (It should be noted at this point that the Directorship of the CMC has recently changed hands. Perhaps time will be the best judge of any improvement in the management of the CMC). A long-term management plan is essential now that the CMC finds itself in a phase of forced re-organisation. Without proper direction/management the CMC will not, in my opinion, be able to build a cohesive centre for global conservation monitoring.

2. Now appears an ideal time for those who "control the purse strings" to exert whatever influence they have available in order that the CMC may best reflect the desires of those benefactors (especially with respect to integration with GRID).

3. The WWF-UK offer of accommodating the CMC in premises located in Godalming, Surrey, UK apparently still stands. At the same time, it is well known that the IUCN would like the CMC to "come under its wing" in Switzerland. Clearly the IUCN has its own interests to consider, however, I believe that a move to Switzerland would have an overall negative effect on the CMC, especially with regards to the further development of the database. (Here "database" is used to refer to an integrated operational CMC data management system).

If it is true that twice the funding would be required to maintain the present UK operation in Switzerland, CMC funding would conceivably have to be tripled or quadrupled in order to meet future requirements. Unless the objective of the IUCN is to reduce the CMC to its barest minimum. Furthermore, the time involved and staff turnover included in such a move could delay development of the database by an additional 12 months.

4. For an operation of the size and stature of the CMC, its CSU is grossly inadequate in terms of hardware, software and personnel. The original Wang system was purchased to meet the word-processing requirements of the TPU. A database management system was promised by Wang but never materialised. No other suitable commercial software has been marketed for Wang computers. Instead of investing in hardware that could support available database management software, it was decided (by whom?) to write a database management system for the Wang in-house, in COBOL. I reached the same conclusions with respect to the CMC computer system as did Rudischhauser and Game in their report to the WWF:

" Database software is complex to write; modern systems take at least tens of man years to write. It is therefore not surprising to find that, although the CMC system is sophisticated for an in-house system, it compares quite unfavourably with commercial software now available. For example:

- it is not very general and is rather inflexible; for example changes to file structures may require extensive modifications to existing programmes, whereas programmes are largely independent of file structures in modern systems.

- new applications may need extensive software to be written; with the tools a good commercial system provides these could be written much more easily.

- analytical and manipulative facilities can be limited; for example, linking of files may need special software to be written, or even restructuring of the database.

- there is inadequate technical documentation of the system; maintenance and development of the system depends on two or three staff with good experience of the programmes. Commercial software should be well documented and supported, and quicker for a programmer to learn than a one-off system like CMC's."

Furthermore, referring back to the Introduction of this report and the claims made in the CMC information pamphlet (see author's underscoring), the system, as is now established, allows basically for the reading and writing of data and information (ie it is an input-output system). It does not function in so far as the analysis and interpretation of data are concerned. The other major claim, made repeatedly, is that the system is integrated. The author found no evidence of the integration of the CMC either on paper or in the computer database. As mentioned above, the four units function independently, with no apparent linkage of their activities.

I must credit the Head of the Computer Service Unit for accomplishing what I consider to be an impossible and, in today's environment of computer software availability, an unnecessary task. I question, however, if the databases are salvageable for transfer to the new system, and whether the CSU has the right attitude to lead the CMC into the next generation.

The preceding comment is not made lightly. Granted, the CMC is investing in new computer hardware (DEC's MicroVAX) and associated software (VAX-Rdb), which tends to negate some of the above points. However, the CSU has functioned in its current mode for years and must by necessity continue to function in that way until a new VAX system becomes fully operational (1-2 years).

Based on personal observations and interviews with CSU staff I was left with the impression that the Computer Services Unit operates with neither the leadership to coordinate an integrated approach to problem solving nor a written mandate to do so. For example:

- The CSU is in a position to take the lead and guide the CMC through re-organisation and integration, both within and with external systems like GRID. When it was suggested that the CSU assume this role - to provide the guidance and expertise in designing an integrated database - I was informed that the CSU had "heard it all before from each individual unit head", and that a new integrated database management system was already envisioned. The plan is to build a database model first (in isolation) and determine it's suitability afterwards. The cart belongs behind the horse.

- It was made clear that for the CMC in general, (and the SCMU in particular), to function properly, a computer terminal was necessary on every desk. This represents a major expenditure and no effort has been made, to my knowledge, to determine if such an expenditure is warranted. The problem now facing staff of the SCMU is that they must book, in advance, for time on the Wang and they find this an inconvenience. According to the report of MacKinnon, "most of the animal species monitoring staff rarely go near the database." This may be due, in part, to difficulties of access, but also because they currently get very little out of the database (see point 5 below). However, the solution to supply more terminals appears to be too large a step in the other direction and an overdose of computer hardware.

- Perhaps unintentionally, barriers have become evident between the various levels of data handling at the CMC. These barriers are a direct consequence of the structure of the database management system. Those who built the database are reluctant to relinquish control, the users are reluctant to learn a system that seems difficult and not particularly user-friendly. In the middle of this are the data which become neglected, and of little use to the programme. Coordination is essential between the database management system, the data and the end-users. Clearly, the CSU should provide this coordination, and they do not.

Accepting the CMC's committment to upgrading the CSU, it is

essential that, along with the improvements to hardware and software, the CMC examine closely the personnel requirements of the Unit and the Centre as a whole. Not only are more staff needed, in the form of data managers/analysts for each Unit, but I believe that new attitudes and new ideas should accompany the modernisation of the data management system.

5. Of the four CMC units interviewed all but the SCMU make regular use of their databases as they now exist. The SCMU database has not been updated in almost 2 years and is of limited use to members of the staff. The Unit finds itself faced with some daunting alternatives:

a. Begin to update the database now, even though it is in a form of little value to staff, and without the support (financial/personnel) to carry out this task, or

b. wait another year or two until a new computer system is operational at which time the SCMU will be 3 to 4 years behind.

6. The amount of information held in "paper" files in each of the units is staggering and the degree of reliance of staff on both paper files and text information will make any change of information/data handling more difficult.

7. Throughout the bulk of the published material available regarding the CMC 'database' and the data held therein, no information is supplied on quality assurance measures taken to provide for the integrity of the data. Questions regarding data verification and subsequent validity must therefore arise, placing qualifications on any interpretations using these data.

8. It has been stated (MacKinnon) that one of the major tasks of the CMC is to monitor the relative degree of threat faced by individual species worldwide. By also maintaining a database on protected areas, the CMC should be able to advise on the relative level of protection being afforded each species, on the inadequacies of current protected area systems to conserve regional biota and make consequent recommendations to establish new reserves. The CMC has largely failed in this task for the reason that it has not been monitoring habitat - a key issue in assessing species status. The CMC species data sheets lack details of habitats used by the species, and contain only crude indicators of geographical distribution as a list of countries of occurrence. It is impossible from such data to make any estimate of the scale of population size or trend.

9. With respect to GRID, it must first be reiterated that computer/data links do not exist within CMC, let alone with outside organisations (save the PADU - US Parks Service link which is mainly a data transfer connection).

All databases allow for the coding of country, and where applicable, state or province. In the case of island constituencies, eg Indonesia, individual islands are coded. Only PADU has a code for biogeographic province. The PADU database also allows for the coding of latitude and longitude (central coordinates for smaller protected areas, and corner coordinates for larger areas - Annex 3). Such information is, however, of limited value to GRID. Protected areas have been digitised outside of the CMC, as in the Africa Elephant Database Project (Annex 4 & 5). This is the direction CMC should be taking, and PADU (with the CSU) should take the lead.

- 1. Digitise global protected areas
- 2. Digitise global biogeographic provinces (after Udvardy, Annex 2)
- 3. Develop a Habitat coding criteria for eventual geographic use
- 4. The CMC should develop into a "Conservation Data" GRID Node.

The last point is made with the following in mind:

a. CMC staff lack GIS experience. (Four staff members have visited the GRID facility in Geneva, where they digitised biogeographic provinces and protected areas for Africa, as well as the distributions for 10 different plant and animal species on the continent. My impression, however, is that they took little away with them). It is therefore suggested that key CMC staff be sent to Geneva and/or Nairobi to become trained in GIS technology.

b. At the same time it may be worth considering a GEMS/GRID person on staff at the CMC (similar to the GEMS staff position at MARC ?).

c. It is suggested to establish a CMC/GRID pilot project whereby one country is chosen for data collection, analysis and integration by the four CMC Units with respect to their geographic relevance. This information will be combined with any additional information available through GRID. A new "Red Data Book" could be produced, eg A Conservation Strategy for _____. This may be seen as similar to the Madagascar project, however, more emphasis would be placed on integrated geographic data - the Madagascar publication contains only three maps; principal towns, rivers and reefs; vegetation; and protected areas. With links through GRID to additional databases, this pilot project may also prove to be a good opportunity to focus attention on conservation and sustainable development. (See Activity Fact Sheet - Annex 6).

10. Finally, the following questions point to an alternative option that UNEP/GEMS may wish to consider:

- What information does CMC currently have that GEMS/GRID could make use of?
- Is this information available from any other sources?
- Is it possible to pay only for the information that is desired?

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ANNEX 1

IUCN/CNPPA Management Categories

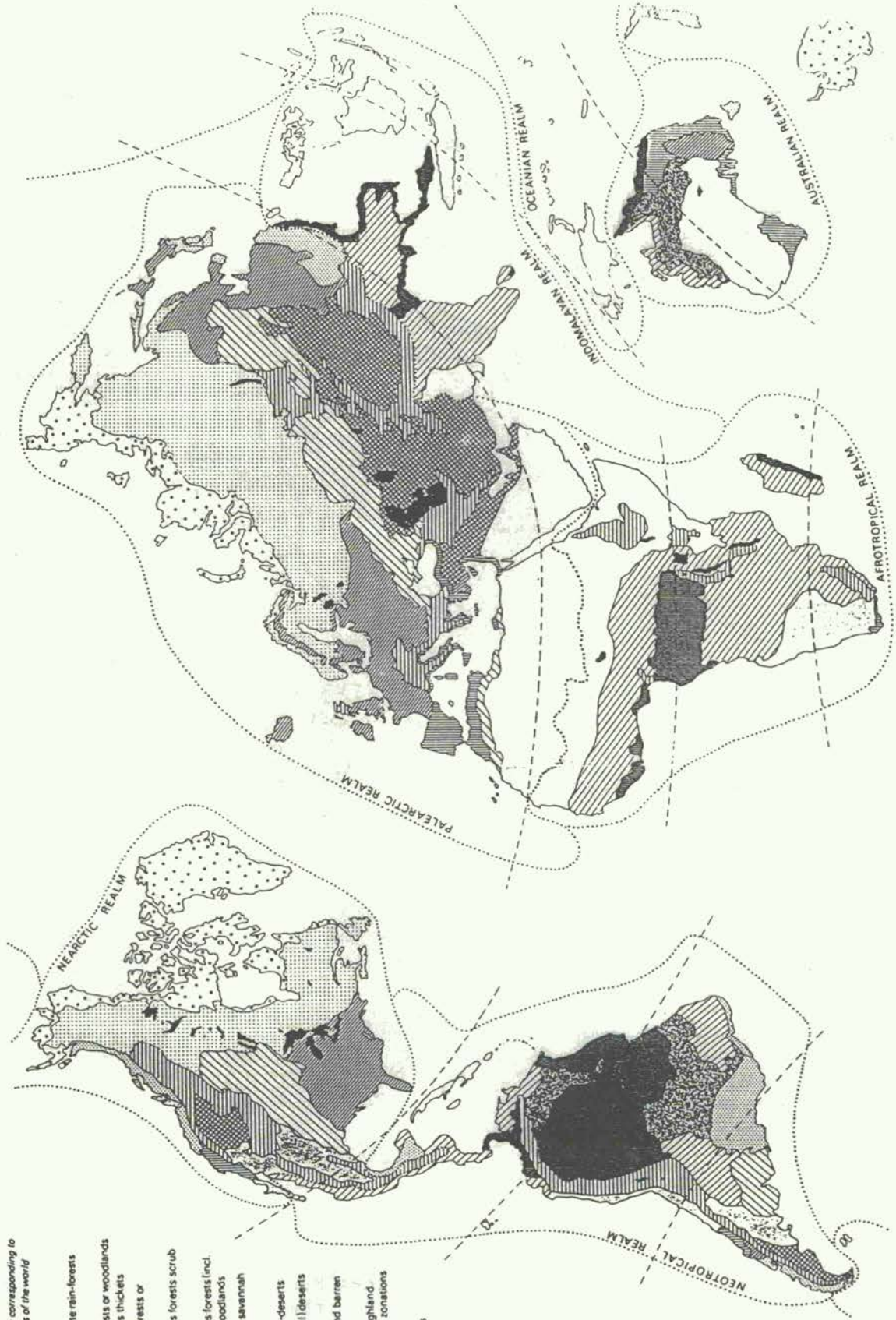
1. Scientific Reserve/Strict Nature Reserve
2. National Park
3. Natural Monument/Natural Landmark
4. Nature Conservation Reserve/Managed Nature Reserve/Wildlife Sanctuary
5. Protected Landscape or Seascape
6. Resource Reserve
7. Natural Biotic Reserve/Anthropological Reserve
8. Multiple Use Management Area/Managed Resource Area
9. Biosphere Reserve
10. World Heritage Site (Natural)
11. Wetlands of International Importance (Ramsar Sites)

ANNEX 2

A NOTE ON BIOGEOGRAPHIC CODING

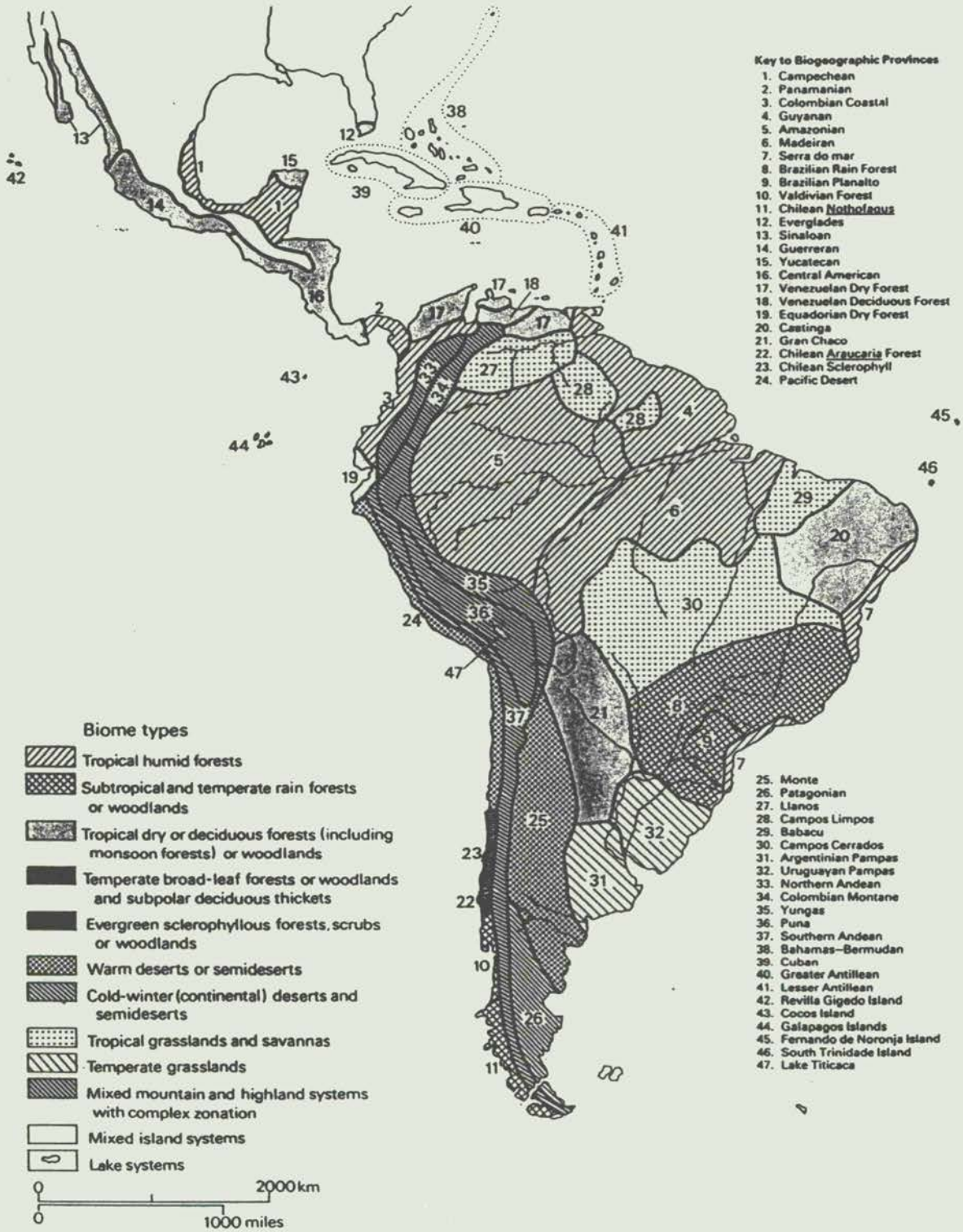
The CMC employs a biogeographic coding system for terrestrial environments devised by Udvardy (1975, revised 1982). Under this system, the world is divided into eight realms and further subdivided into 227 biogeographic provinces. Included in the code for each province is an identifyer for the dominant biome type therein.

TERRESTRIAL BIOGEOGRAPHIC REALMS OF THE WORLD - BIOME TYPES OF MAJOR PROVINCES



after Udvardy 1975
source: Managing Protected Areas in the Tropics, IUCN/UNEP, 1986

BIOGEOGRAPHICAL PROVINCES OF THE NEOTROPICAL REALM

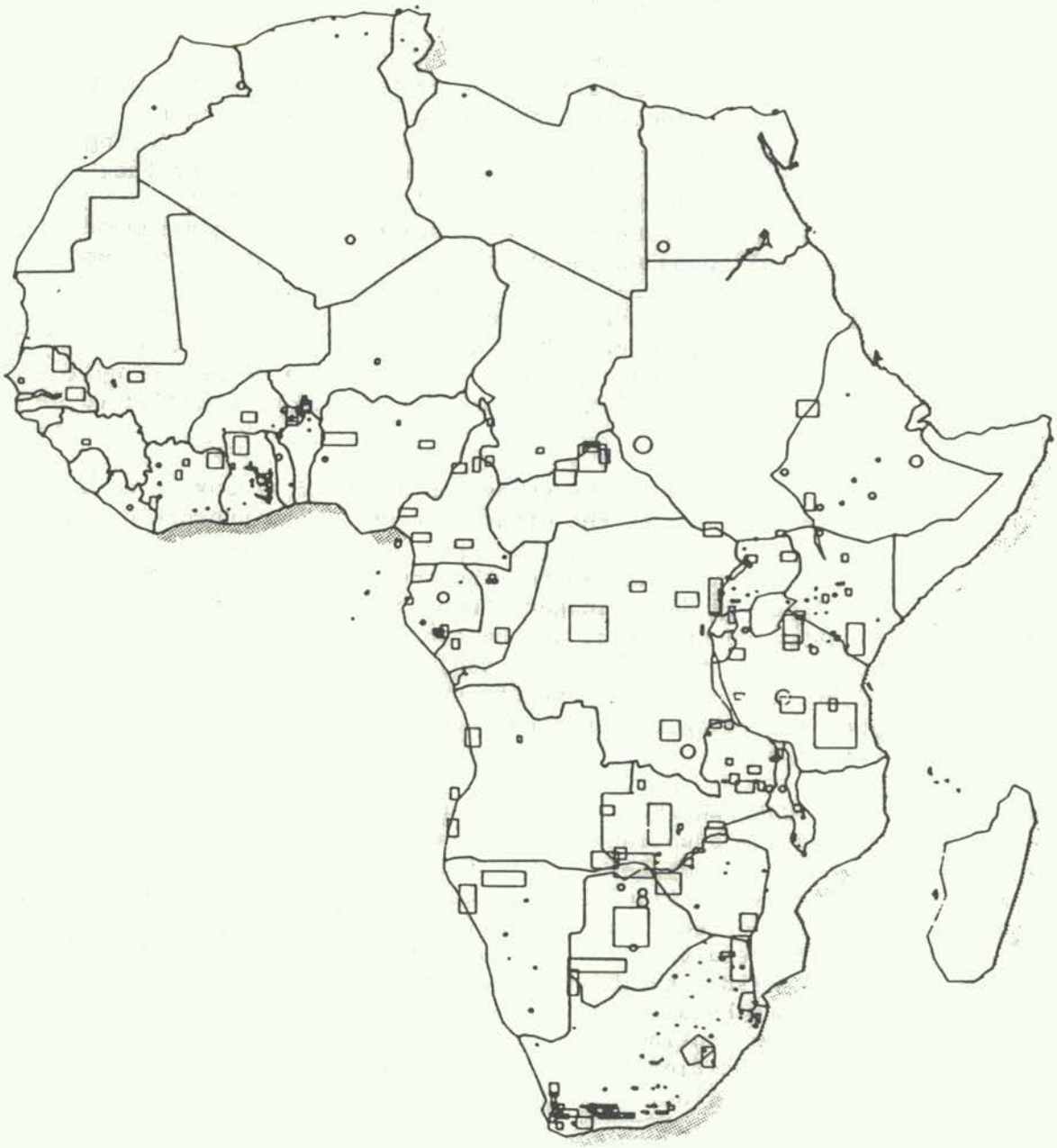


after Udvardy 1975

source: Managing Protected Areas in the Tropics, IUCN/UNEP, 1986

ANNEX 3

AFRICAN PROTECTED AREA DISTRIBUTION



source: PADU

ANNEX 4

NOTES ON THE PROTECTED AREAS MAP
(A. Burrill - GRID)

The protected areas map included in GRID is based on a map produced for IUCN as part of a consultants' report reviewing and evaluating the parks and reserves of sub-Saharan Africa. (ref -- MacKinnon, J and K, 1986. Review of the Protected Areas System of the Afrotropical Realm, IUCN and UNEP). The MacKinnons worked initially from the information and maps held by the Protected Areas Data Unit of IUCN. The PADU files contain descriptions and statistics for most of the national parks and nature reserves in the area. During the course of the consultancy, J MacKinnon visited several of the countries of sub-Saharan Africa and obtained more up-to-date information and maps from park officials, scientists and government ministries. The MacKinnons excluded from their study areas of less than 5000 hectares (50 sq kms); they felt that such areas contributed little to the protected areas system on a continental scale, despite local importance. The study does, however, cover areas which are presently only "proposed" parks or reserves, as well as certain forest reserves which they believe should be upgraded to nature reserves.

Each of the areas included in the study was assigned a ranking on a scale from 1 to 4 to indicate the effectiveness of the protection in the area. (1 = good, 2 = moderate, 3 = poor, 4 = no effective protection). All of the rankings for the countries of southern Africa were assigned by park managers from the region at a meeting in Malawi in 1985. For the rest of the continent, rankings were assigned on the basis of PADU data in conjunction with information obtained by J MacKinnon from the countries involved. Whenever possible, experts working in the area were consulted and asked to review the rankings.

As a part of the UNEP/WWF/ELSA Africa Elephant Database Project, the MacKinnon map and the associated effective protection rankings were entered into the GRID computer. Most of the "major" protected areas were subsequently re-digitised from large scale maps as they were found to be too imprecisely delineated for use in the GIS, on the original map. The resulting map was evaluated at the AERSG meeting (Nyeri, Kenya, May 1987) by individuals familiar with the parks system, and found to be satisfactory with the exception of the effective protection rankings for some of the areas, especially in Gabon. These were modified in the GRID database as recommended by the experts at the meeting.

ANNEX 5

AFRICAN PROTECTED AREAS BOUNDRIES

source: modified from MacKinnon and MacKinnon, 1986

ANNEX 6

GRID/GEMS/UNEP
ACTIVITY FACT SHEET

Title: CMC/GRID Pilot Project: Development of a National Conservation Database for a Developing Country

Geographical Scope: National with global implications. Country to be chosen

Implementation: UNEP-GRID and IUCN-CMC

Duration: One year Cost: To be determined

Background:

GRID, the Global Resource Information Database, aims, inter alia, to promote GIS (geographic information system) skills in developing countries and the concomitant development of national environmental and resource databases for land use planning, resource management and various development activities.

IUCN-CMC (Conservation Monitoring Centre), currently undergoing a period of re-organisation, is a centre with considerable assets in the form of global conservation information, including: protected areas, threatened plants and animals and wildlife trade.

This pilot project offers an ideal opportunity to integrate CMC activities and standardise their data handling/transfer methodologies with those of GRID. At the same time attention can be focused on conservation strategies as they pertain to sustainable development in a developing country.

Objectives:

Primary - To establish a working model for the integration of CMC unit databases and harmonisation of data for eventual incorporation with GRID.
Secondary - To focus attention on issues related to conservation strategy and the sustainable development of natural resources in a developing country.

Outputs:

A national database of geo-referenced and digitised conservation and environmental data within GRID.

IUCN-CMC staff trained in the use of GIS software, and familiar with the operations of GRID - for the future development of a global conservation database.

Training also of national experts from the country to be chosen, and development of the basis for a National Conservation Strategy in a particular developing country.

Activities:

The main activities will include:

- the compilation of data from the CMC units
- geo-referencing existing conservation data
- digitising protected areas, Udvardy bio-geographic regions and habitats
- collating and digitising national data of environmental/ conservation relevance, eg land-use, vegetation, rainfall, population etc.

Government and donor interest will be aroused through the demonstration of the database and model applications.