ASSESSING THE CONSERVATION STATUS OF THE WORLD'S TROPICAL FOREST

SUMMARY REPORT
of the
WCMC Tropical Managed Areas Assessment Project

carried out
with financial support from

OVERSEAS DEVELOPMENT ADMINISTRATION, UK

A contribution to the FAO Forest
Resources Assessment 1990

December 1993

WORLD CONSERVATION
MONITORING CENTRE

The mission of the
World Conservation Monitoring Centre is to provide
information on the status, security and
management of the Earth's biological diversity.

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1. INTRODUCTION

Concern over the depletion and degradation of the world's tropical forests and woodlands led to the FAO/UNEP Tropical Forest Resources Assessment Project, carried out from 1979 to 1981. This project, which covered 76 tropical countries, gave an overview of the situation at that time and provided insight into the trends in forest use and loss. In an attempt to improve and update this baseline information, a second project, the Tropical Forest Resources Assessment was conducted by FAO, working to a baseline of 1990.

An *ad hoc* Meeting of Experts on Forest Resource Assessment, held in Kotka, Finland in October 1987, recommended that the 1990 Assessment "should give more explicit emphasis to the service functions of forest, including environmental protection and nature conservation." To accomplish this goal, the group recommended that the project seek supplementary information on legally established protected areas, including forest reserves, and that boundaries of these areas, be entered on a Geographic Information System (GIS) to allow for further analysis.

The WCMC *Tropical Managed Areas Assessment* (TMAA) 1990 was conducted over a three-year period from July 1989 to June 1992, and was funded by the British Overseas Development Administration. It was carried out in collaboration with IUCN - The World Conservation Union, in particular its Forest Conservation Programme and Commission on National Parks and Protected Areas, and in cooperation with the Food and Agricultural Organization (FAO) of the United Nations.

The overall objective of the project was to complement the *FAO Forest Resources Assessment 1990* by quantifying the contribution of forestry, wildlife and other sectors to nature conservation in the tropics. In so doing, this would help to identify gaps in existing managed and conservation area networks and, particularly with respect to the forestry sector, highlight the need for increased allocation of tropical forests for protection and conservation purposes.

The following specific objectives for the project were agreed with ODA with respect to each of the countries covered by the FAO Tropical Forest Resources Assessment Project

- to update information held by WCMC on national protected area systems.
- to compile similar information on areas other than those designated primarily for nature conservation, particularly with respect to forest reserves managed for sustainable resource use;
- to present this information in short accounts of the state of national managed and conservation area systems, drawing the main conclusions into regional summaries;
- to map managed and conservation area systems on a Geographic Information System;

- to use this GIS facility to analyze the coverage of different vegetation types or bioclimatic units by managed and conservation areas, and to examine the coverage afforded to different regions by those systems;

- to prepare analyses of managed area coverage by forest type and management category, and present this in a form compatible with the *FAO Forest Resources Assessment 1990* tables and reports; and

- to prepare further analyses and reports as time permitted.

World Conservation Monitoring Centre

As an international, non-profit making charity, WCMC was established by three international conservation agencies: IUCN-The World Conservation Union; WWF-World Wide Fund for Nature; and UNEP-United Nations Environment Programme, all of which were involved in the development and evolution of the Centre from the outset. WCMC's mission is to provide research, information and technical services so that decisions affecting the conservation and sustainable use of biological resources may be based on the best available scientific information.

WCMC contributes information to GEMS (UNEP Global Environment Monitoring System), which is a collective programme of the world community to acquire, through global monitoring and assessment, the data that are needed for the rational management of the environment. GEMS is an element of the United Nations Earthwatch programme. The Centre holds the most comprehensive information on *global* nature conservation of any agency in the world, and fills a very specific niche in the collating and dissemination of information on biodiversity at this level.

The operational units which undertake a coordinated programme within WCMC are: Protected Areas; Species; Habitats; Information Technology/GIS; and International Operations. For the TMAA project, the extensive database on protected areas and other managed areas (principally forest reserves) of the Protected Areas Data Unit was utilised and developed, as was the GIS capability at the Centre.

2. METHODOLOGY

2.1 Information Collection

The *WCMC Tropical Managed Areas Assessment 1990* covers 106 countries and territories in the tropics, split into three regions (Latin America, Africa, and Asia & Pacific), and 12 subregions (see Annex 1). The study focused on a wide range of nationally designated *managed areas*, particularly those having a protection or conservation role (which are referred to as *conservation areas*). The study was directed primarily at the forestry and wildlife sectors, within which the majority of designated areas are included. Additional sectors (eg. national monuments, indigenous reserves) were included as appropriate.

Forestry sector Prior to this assessment, little systematically collected information on managed areas in the forestry sector was available. WCMC contacted forest administrations

in each tropical country, asking for statistics and maps of the forest estate, information relating to its management and copies of relevant legislation.

Letters to forest administrations in each of the countries and territories listed were sent out during the second quarter of 1990. Responses were received initially from 20% of countries, but, following reminders, the response rate had increased to 40% by April 1991. Efforts in the latter part of 1991 and early 1992 ensured that by the end of the project, 52% of tropical countries had responded.

Information obtained directly from forest administrations was supplemented by information gathered by FAO for other purposes, particularly for those countries and territories which did not respond to WCMC's requests. In the absence of any recent data statistics were used from the *Tropical Forest Resources Assessment 1980* (FAO, 1981) to quantify the extent of natural forest under production. Additional information was obtained from the libraries of the FAO Forest Department in Rome, and the Oxford Forestry Institute. Copies of much of the forest legislation were obtained from the FAO Forest Resources Division.

Wildlife sector WCMC already holds an extensive body of information on conservation areas within the wildlife sector. This information has been gathered over many years through direct contact with the appropriate government and other agencies responsible for their management. It is constantly being updated as existing areas are upgraded in their conservation status or enlarged, and as new ones are created.

Relevant agencies within all tropical countries were contacted at some stage during this project for their latest lists and maps, or asked to check and update material already available to WCMC. Much of this information-gathering exercise was conducted under the auspices of a parallel project to compile *Protected areas of a world: a review of national systems* (IUCN, 1992), for presentation at the IV World Congress on National Parks and Protected Areas, held in Caracas, February 1992. These two projects complemented each other well.

Maps Where possible, maps of managed areas were obtained from the relevant government authorities within the forestry, wildlife and any other sectors, in order to digitise their boundaries using a Geographic Information System. In addition, the map libraries of the University of Cambridge and Oxford Forestry Institute were searched for relevant maps. Maps were also obtained from the Natural Resources Institute of the Overseas Development Administration (ODNRI) and Hunting Technical Services, UK.

2.2 Information Management

WCMC manages its information on conservation areas in the following ways:

- hard copies of all bibliographic material (eg. books, papers, reports, legislation), correspondence and maps are filed on a geographic basis;

- relevant data are extracted from this raw material and stored electronically in the WCMC *Protected Areas Database*; boundary maps are digitised using a Geographic Information System (ARC/INFO) and stored within the WCMC *Biodiversity Map*

Library (see Annex 2) listed to tabular data in the WCMC *Protected Areas Database*; and

- texts describing national conservation area networks, their legal and administrative basis, are compiled using a standard format and stored electronically.

- texts describing individual conservation areas are also compiled, and stored in the same way, but these are not relevant to this study.

For purposes of this project, the WCMC *Protected Areas Database* was expanded to include other managed areas, notably forest reserves. The database was also modified to enable the function of forest reserves to be recorded as *production*, *protection* or *conservation*, in line with the classification used by FAO (1990). This database currently comprises some 40,000 records, of which some 9,136 were relevant to this study. Summary statistics of the forest estate provided by forest administrations were entered into the modified database.

WCMC's Geographic Information System (GIS) is able to provide maps and supporting information on the Earth's ecosystems, protected areas and threatened species. GIS data are managed in the *Biodiversity Map Library* which can supply geographical information to users who are untrained in GIS techniques. This allows users to: access to WCMC's conservation data holdings; create, browse, query, capture and plot maps; insert updated maps and database information; check the integrity and quality of the data; and customise maps for individual applications

The system stores global data at a nominal scale of 1:1 million. At present, global biodiversity datasets include: protected areas, tropical forests, mangroves, coral reefs, wetlands, sea turtle nesting beaches, endemic bird areas and centres of plant diversity. In addition, complete vegetation maps are available for some 40 developing countries. Coarser scale datasets showing global vegetation and ecosystem classifications of between 1:5 and 1:25 million are also held. Topographical information from the Digital Chart of the World (DCW) is included.

The *WCMC Tropical Managed Areas Assessment 1990* was the first attempt to systematically assess the contribution of the forestry sector to nature conservation at the international level. This assessment is therefore in many respects a prototype and in time will be significantly improved. However, in many cases this will also require major improvements in the management of information relating to protection and conservation of forest reserves, at the national level.

3. INFORMATION

3.1 Project Reports

The project reports were submitted to ODA and FAO in three parts:

Part I	*Subregional Reviews: Tropical Asia & Pacific*; *Tropical Africa*; and *Tropical Latin America*
Part II	*Regional and Global Review*
Part III	*Mapping Tropical Managed Areas.*

(i) Part I - Subregional Reviews

The first section of each Subregional Review (***Historical Perspective***) provides an overview of the way in which nature conservation has evolved in each country through legal and administrative regimes. This is followed by a section which reviews current **nature conservation policy and legislation** within forestry, wildlife and other sectors. An accompanying table highlights the sector to which individual pieces of legislation apply (i.e. forestry, wildlife or additional), together with management objectives for each designation as legislated or laid down in policies. This information is illustrative of the provisions which have been made for conservation, reflected in the establishment of conservation or management areas. The third reviews current administration within each sector.

The fourth section, entitled ***Managed Areas Status***, provides information on ***Managed Areas within the Forestry Sector***, ***Conservation Areas within Forestry, Wildlife and Additional Sectors***, and the ***Contribution of the Forestry Sector to Nature Conservation***, and is supported by tables which provide a breakdown of the area found in notified natural forests according to production, protection and conservation functions. The fourth section was further broken down to provide information on ***Coverage***, ***Representativeness***, ***Integrity*** and ***Effectiveness***.

i) ***Coverage*** Statistics were generated analysing the coverage of national conservation area networks in terms of total and partial protection, and assessing the relative contribution of the forestry, wildlife and additional sectors. The coverage does not extend to privately-owned and managed reserves. Coverage by national conservation area networks is expressed as a percentage of the total area of a country, and examined in relation to the widely-accepted target of 10%. This is considered to be a realistic goal for many countries, taking into account other demands on land for economic development and subsistence needs.

ii) ***Representativeness*** The representativeness of conservation area networks is examined with respect to major habitats, and gaps identified from other studies are highlighted. Particular attention is given to whether or not plans based on systematic surveys have been formulated to ensure that the full range of a country's biological diversity is represented within its conservation area network.

iii) ***Integrity*** Mean size and the frequency distribution of conservation area sizes are used as a measure of the integrity of conservation area networks, based on the assumption that the effectiveness of a conservation areas network in maintaining biological diversity will partly be a function of the size of its constituent units.

iv) ***Effectiveness***: The effectiveness with which conservation areas are managed is assessed qualitatively.

The fifth section of the TMAA report deals with ***Future Prospects***. Official proposals to expand conservation area networks were reviewed, along with other national initiatives to *strengthen networks* through specific projects and programmes, to *overcome economic constraints* through funding mechanisms, and to *improve management* through new approaches. Participation in international and regional *conventions and programmes*,

particularly with respect to the World Heritage Convention, the Ramsar (Wetlands) Convention and the UNESCO Man and the Biosphere Programme were also reviewed, together with attempts between adjacent countries to manage conservation areas under *cooperative agreements*. Finally, section six of the reports provided an overview of ***Priorities for Action***. These priorities were based on descriptive information, and from an analysis of the data presented in the tables of the report.

Part II - Regional and Global Review

These analyses are essentially similar to those already described, but carried out at the regional and global level to summarise the major trends across each of the three continental regions, and at a global level.

Part III - Mapping Tropical Managed Areas

The third section of the report contains maps of the managed areas by country, organized by subregions. Over the past two years WCMC has collated, analysed and mapped cartographic data for managed areas in the tropical countries covered by the *Tropical Managed Areas Assessment*. The maps provide location and boundary information on the conservation, protection and production areas listed in the subregional reports (Part I). For some countries all managed areas have been mapped; for others coverage is partial, depending on data availability. Information on forest reserves is not comprehensive as data are often not available, but data are being completed for an increasing number of countries.

Ecofloristic Zone Analysis

One means of assessing protected areas coverage is to review their distribution against a map of vegetation zones, or biogeographic zones. For the purposed of forest distribution analysis, FAO worked with others to derive maps of "Ecofloristic" zones. At their request managed areas coverage was analysed using this system, and the results are presented in this report. Some of the findings are described below.

In addition, a range of further tables, statistics and texts were provided to FAO on request, for inclusion in various interim reports, including their report to the UN Conference on Environment and Development.

3.2 Protected Areas of the World

Developed in conjuncture with TMAA is the four-volume series ***Protected Areas of the World: A review of national systems*** (IUCN, 1992), compiled by WCMC. This systematic country-by-country review of the world's conservation areas was prepared as a briefing document for the IV World Parks Congress, Caracas, 10-21 February 1992 under a related project funded in part by British Petroleum. It comprises descriptions, lists and maps of national conservation area networks. A considerable amount of information on national conservation areas and forest networks generated by the forest project was incorporated within three of the four volumes. Annex 3 presents a chapter output (Ghana) from this publication.

3.3 Contribution to Other WCMC Initiatives

The collection and analysis of data for the project has contributed to a number of other projects at WCMC. A selection of these are presented below:

Data collection contributed to the preparation of the three volume series ***The Conservation Atlas of Tropical Forests***, again supported by British Petroleum. This series covering **Asia-Pacific**, **Africa** and **Latin America** (in preparation) provides information on the distribution of tropical forests, and presents an overview of forest degradation and loss. National sections describe rain forest resources, extent, type, degree of degradation, their faunal, floral, ecological and economic importance, the major causes of forest loss, forest/wildlife protection, and programmes for management, reafforestation, and restoration. The text is accompanied by maps, showing location of present forest cover, and extent of protected areas and other sites critical for the conservation of biological diversity.

In the course of WCMC's collaboration with FAO's Forest Resources Assessment 1990, the absence of baseline inventory data on plants and animals for many tropical conservation areas was identified as meriting further investigation. The report ***Status of Plant and Animal Inventories for Protected Areas in the Tropics*** (see Section 4.6), was the outcome of the pilot project WCMC carried out in collaboration with the Oxford Forestry Institute (funded through the ODA Strategy Programme for Research on Forestry and Agroforestry).

Managed area datasets are currently supporting the initiative ***TREES - Provision of Tropical Forest Information***. The TREES project managed by the EC Joint Research Centre in Italy, is currently compiling a baseline pan-tropical forest map from AVHRR satellite imagery and is exploring ways to monitor changes in the forests on a regular basis. Other relevant information from many sources is being incorporated and managed within a Tropical Forest Information System, to help provide a more holistic picture of the status and safety of the world's tropical forests.

The ***Forest Resource Accounting Project*** has been carried out as a pilot study in Indonesia, Ecuador and Cameroon, in collaboration with the International Institute for Environment and Development (IIED) and funded by ODA. The project proposed a strategic model to assist ITTO producer countries to monitor progress towards sustainable forest management. WCMC datasets, developed through the capture and management of information on designated areas within the forest sector, and the experience gained in the handling of forest data in a GIS, are likely to make a significant contribution to the forest inventory and monitoring aspects of this project.

Other initiatives which the data and analyses support include the IUCN/EEC ***Environmental Profiles*** (1988-present), a World Bank (1993) supported study on ***Ecologically Sensitive Sites in Africa***, and a new initiative ***Monitoring the State of Tropical Forests***, supported by Bull Computers, which aims to provide a systematic overview of the extent, condition, and vulnerability of the world's tropical forests.

3.4 Access to Information

All of the material compiled as a part of the project is available through WCMC. Original reports and correspondence are on file, and the extracted information is included within various databases. In particular, basic information on all protected area systems is incorporated within the WCMC *Protected Areas Database*, and maps are incorporated within the WCMC *Biodiversity Map Library*. The information is available for use by others in their own studies, and further information on WCMC databases and services is available from the Centre.

ımary and analysis

:ta compiled as a part of this and related studies provides the material for deriving e of summary tables, and for undertaking a number of analyses. This section :s examples of a range of such work.

he Contribution of Managed Areas within the Forestry Sector

roject collected for the first time a substantial body of information on legally ıted forests areas, identifying the basic functions for which the site is established: *tion, protection* and *conservation*. Some of this data is summarised in Table 1, shows that:

Managed areas within the forestry sector cover at least 10.9% of the tropical region, with wide variation between subregions.

Rather more of this area is assigned to production (6.5%) compared to the areas assigned to protection (3.0%) and conservation (1.5%).

In absolute terms, designated areas in the forest sector are the most extensive in Tropical Latin America (2.16 million sq.km), followed by Tropical Asia & Pacific (2.22 million sq.km). By comparison, there is relatively poor coverage in Tropical Africa (0.84 million sq.km).

In relative terms, Tropical Asia & Pacific has the most extensive forest sector, (24.9%), followed by Tropical Latin America (13.1%), whilst Tropical Africa has least within notified forests (3.8%).

Tropical Asia & Pacific Production forest reserves are the principal component of the forest sector, covering 16.9% of the region, compared to 4.9% assigned to protection and 3.0% to conservation functions.

Tropical Africa There is an approximate equivalence between protection and conservation forests (each less than 1%), whilst production forests cover 2.6% of the region. Madagascar, included here within the Tropical Africa region, is noteworthy in that conservation forests are more than twice as extensive as production forests, although this is a function of the complete protected areas network being managed under the forestry umbrella.

Tropical Latin America In proportional terms the forest sector is most extensive in Central America, with 35.9% of the subregion covered, the great bulk of which (30.6% of the subregion) is assigned to a protection function. Much of this comprises more than 200 protection forest zones in Mexico, covering some 68,000 sq.km.

Caribbean The relative contribution is not insignificant (3.6% of the subregion), although the absolute coverage on a global basis is very small (<0.1% of the tropics).

Table 1 Extent of notified natural forests (eg forest reserves), classified by forest function.

REGION Subregion		Production		Protection		Conservation		Total	
	Area	Area	(%)	Area	(%)	Area	(%)	Area	(%)
TROPICAL ASIA & PACIFIC									
South Asia	4,122	594	14.4	10	0.2	3	0.1	607	14.7
Continental SE Asia	1,902	201	10.6	97	5.1	198	10.4	496	26.1
Insular SE Asia	2,444	717	29.3	331	13.5	67	2.7	1,115	45.6
Oceania	453	0	0.0	0	0.0	0	0.0	0	0.0
Regional Total	8,921	1,512	16.9	438	4.9	268	3.0	2,218	24.9
TROPICAL AFRICA									
West Sahelian Africa	5,280	169	3.2	51	1.0	13	0.2	233	4.4
East Sahelian Africa	4,897	16	0.3	1	0.0	23	0.5	40	0.8
West Africa	2,038	130	6.4	15	0.7	50	2.5	195	9.6
Central Africa	3,983	30	0.8	4	0.1	12	0.3	46	1.2
Tropical Southern Africa (*)	6,163	238	3.9	7	0.1	83	1.3	328	5.3
Regional Total	22,361	583	2.6	78	0.3	181	0.8	842	3.8
TROPICAL LATIN AMERICA									
Central America & Mexico	2,396	120	5.0	732	30.6	8	0.3	860	35.9
Caribbean	690	9	1.3	8	1.2	8	1.2	25	3.6
South America	13,416	870	6.5	161	1.2	248	1.8	1,279	9.5
Regional Total	16,502	999	6.1	901	5.5	264	1.6	2,164	13.1
GRAND TOTAL	47,784	3,094	6.5	1,417	3.0	713	1.5	5,224	10.9

* NB Includes Madagascar
All areas are given in Sq.km x 1,000

Table 2 Managed areas in the forestry (conservation and protection), wildlife and additonal sectors.

REGION Subregion	Area	Forest Sector		Wildlife Sector		Additonal Sectors		Totals	
		Area	(%)	Area	(%)	Area	(%)	Area	(%)
TROPICAL ASIA & PACIFIC									
South Asia	4,122	13	0.3	248	6.0	0	0.0	261	6.3
Continental SE Asia	1,902	295	15.5	70	3.7	8	0.4	373	19.6
Insular SE Asia	2,444	397	16.2	228	9.3	0	0.0	625	25.6
Oceania	453	0	0.0	10	2.2	0	0.0	10	2.2
Regional Total	8,921	705	7.9	556	6.2	8	0.1	1,269	14.2
TROPICAL AFRICA									
West Sahelian Africa	5,280	64	1.2	334	6.3	0	0.0	398	7.5
East Sahelian Africa	4,897	24	0.5	409	8.4	0	0.0	433	8.8
West Africa	2,038	65	3.2	75	3.7	0	0.0	140	6.9
Central Africa	3,983	15	0.4	252	6.3	6	0.2	273	6.9
Tropical Southern Africa (*)	6,163	91	1.5	907	14.7	0	0.0	998	16.2
Regional Total	22,361	259	1.2	1,977	8.8	6	0.0	2,242	10.0
TROPICAL LATIN AMERICA									
Central America & Mexico	2,396	740	30.9	151	6.3	14	0.6	905	37.8
Caribbean	690	16	2.3	31	4.5	2	0.3	49	7.0
South America	13,416	409	3.0	1,002	7.5	1,191	8.9	2,602	19.4
Regional Total	16,502	1,165	7.1	1,184	7.2	1,207	7.3	3,556	21.5
GRAND TOTAL	47,784	2,129	4.5	3,717	7.8	1,221	2.6	7,067	14.8

* NB Includes Madagascar
All areas are given in Sq.km x 1,000

4. 2 Comparison of Managed Areas within Forestry, Wildlife and Additional sectors Managed for Nature Conservation

The data compiled allows a comparison of the relative conservation contribution by the forest, wildlife and additional sectors excluding production forests. This is illustrated in Table 2. This table, which excludes designated forest with a production function, shows that:

- Managed areas in the forest, wildlife and additional sectors taken together cover 14.8% of the tropical region, which is a very significant proportion.

- The wildlife sector is responsible for areas covering 7.8% of the tropics, whilst additional sectors including for example, indigenous reserves in Latin America, cover 2.6%.

- Significantly, the forest sector contributes another 4.5% of the tropical region in protection and conservation areas, underlining the importance of sites in the forestry sector to conservation.

- The greatest contribution to the global total comes from Tropical Latin America, where the additional sector (mainly indigenous reserves) contributes more than one third of the managed areas network in this subregion, and a significant proportion of the entire tropical conservation areas network. Such areas warrant further systematic research.

- The area managed for nature conservation in forest and wildlife sectors at the regional level in Tropical Latin America and Tropical Asia & Pacific are broadly similar. However, in Tropical Africa the wildlife sector is some eight times larger than the forest sector.

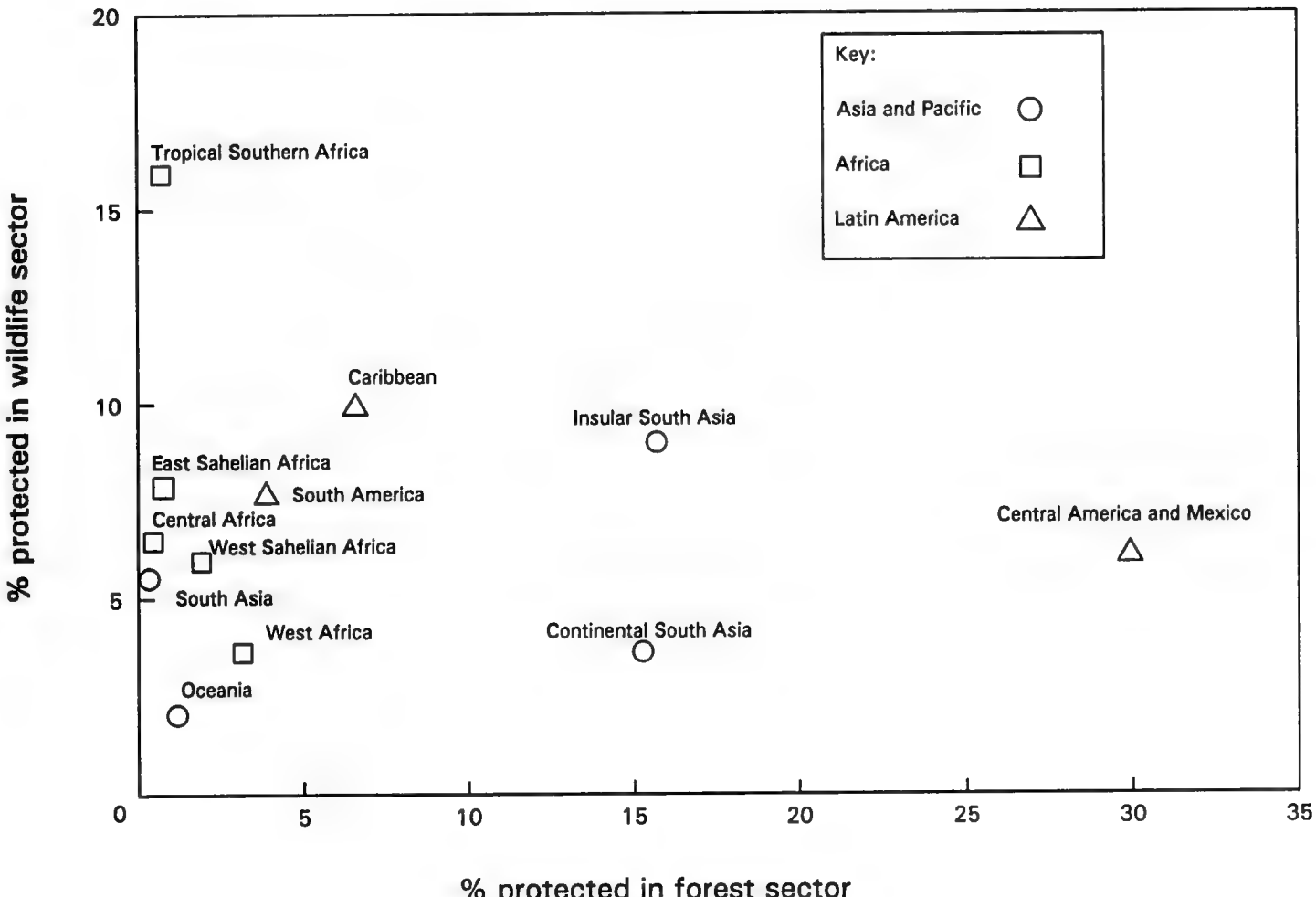
Plotting percentage land protected in the forest sector (protection and conservation) versus percent protected in the wildlife sector (Figure 1) yields further interesting observations.

- In some regions the forest sector covers a much greater area than the wildlife sector, eg Central America and Mexico and in the Continental South Asia sub-region. In countries where this is found, there may be a strong case for a review of the forest sector in order to assess its conservation potential.

- In regions such as East Sahelian Africa, the extent of the wildlife sector far exceeds that in the forest sector. This is due to there being relatively little forest in the region (as can be seen from Figure 4), and to the establishment of large national parks and conservation areas for typically savanna wildlife.

- South Asia appears to have a very limited forest sector, yet this is predominantly due to India's forest reserves being classified entirely as production areas.

Figure 1. Comparison of percentage land protected in the forest sector (protection and conservation) versus percentage protected in wildlife sector



4.3 Distribution of designated areas

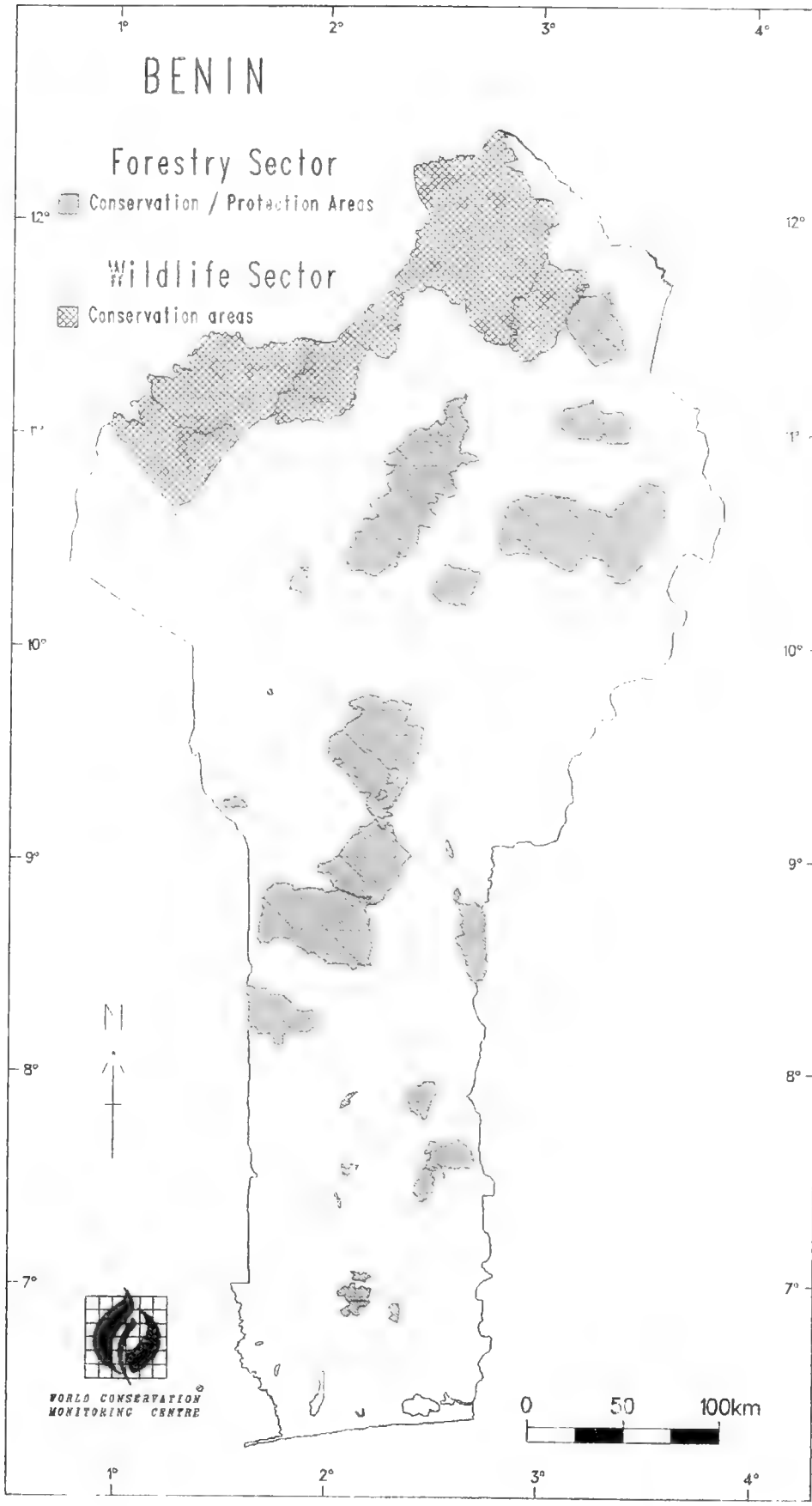
In order to adequately protect the full range of biodiversity, protected areas must be systematically distributed throughout the country. Comparison of maps of protected area distribution in Benin (Figure 2) and Costa Rica (Figure 3) illustrate some of the differences.

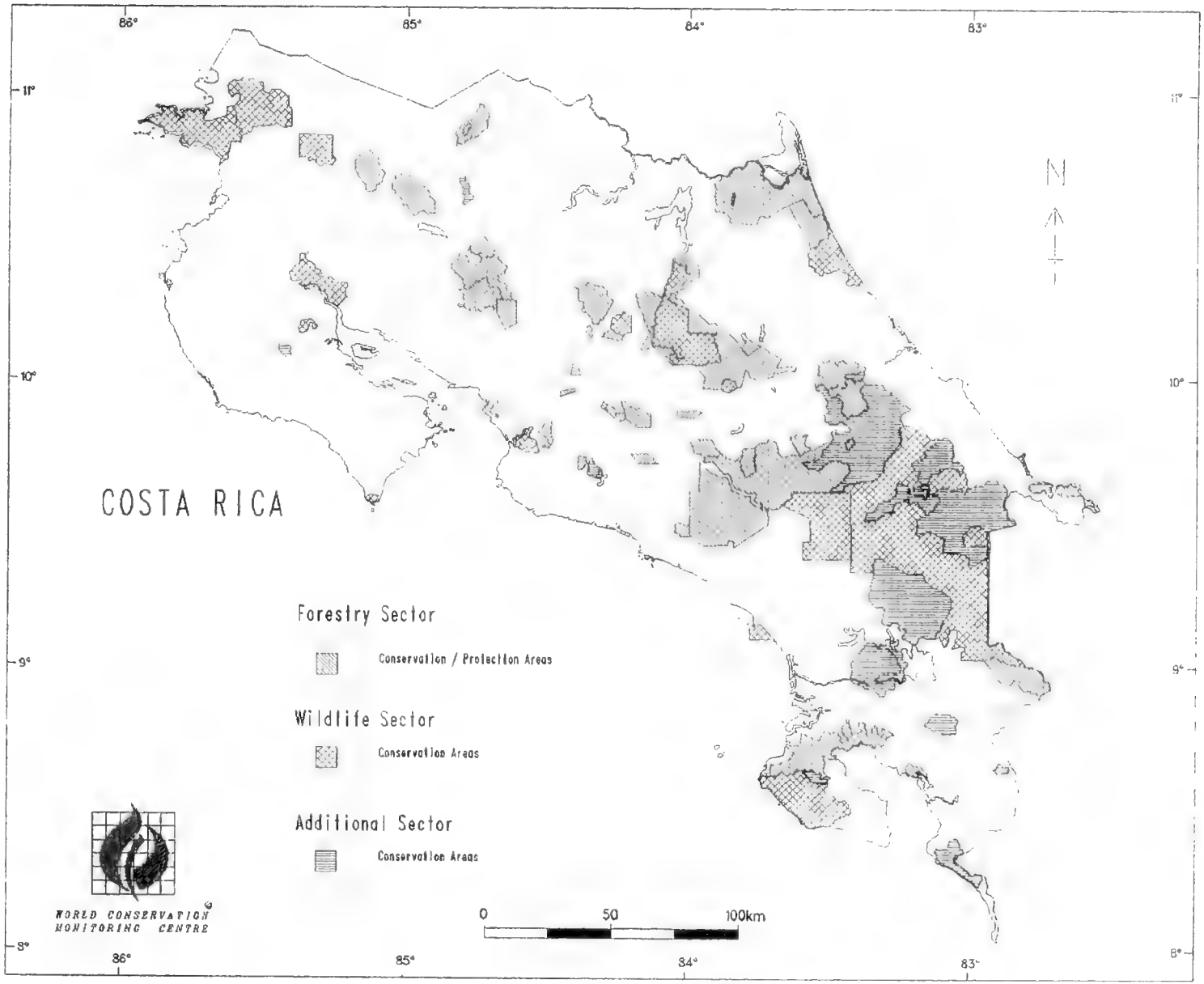
- The wildlife sector in Benin covers 12% of the country, but is found exclusively in the savanna/arid lands in the north; tropical forest areas are not included. The forest sector (which also covers about 12% of the country) has a more even distribution.

- The wildlife sector in Costa Rica (10%) is better distributed across the country, and conservation and protection areas in the forest sector (11.5%) and additional sector areas (11.3%) are also well distributed. In total, 19 out of 20 Holdridge life zones and transition zones found in Costa Rica are included within the protected areas system.

- The forest sector plays an important role in many countries, increasing the range of habitats under protection, as is immediately apparent from the Benin map. In circumstances where forest reserve systems are extensive and well distributed and wildlife protected areas are not, there is urgent need for review of the conservation value of areas in the forest sector.

- This comparison underlines the fact that simple statistics alone do not provide the full picture. Managed areas must be systematically mapped for comprehensive systems analyses to be carried out.


BENIN
Forestry Sector
Conservation / Protection Areas
Wildlife Sector
Conservation areas
1°
2°
3°
4°
12°
11°
10°
9°
8°
7°
N
WORLD CONSERVATION MONITORING CENTRE
0
50
100km


86°
85°
84°
83°
11°
10°
9°
8°
N
COSTA RICA
Forestry Sector
Conservation / Protection Areas
Wildlife Sector
Conservation Areas
Additional Sector
Conservation Areas
0
50
100km
WORLD CONSERVATION
MONITORING CENTRE

4.4 Percent of land forested against percent of land within designated areas.

In this section, summary totals for each sub-region have been compared with the forest cover statistics presented by FAO to UNCED in 1992. Figure 4 provides data for the forest sector (protection and conservation reserve only), and Figure 5 for the wildlife sector.

- One would intuitively expect that the greater the area of forests, the greater would be the area of forest reserve, up to a certain point.

- Certain areas such as Central Africa and South America have very high forest cover, but very low percentage of land designated in the forest sector. This may be due to a lack of information on our part, or to the fact that the forest sector is poorly developed. In the latter case, opportunities to develop the forest sector may exist, and should be explored further. Opportunities for this would be clarified by similar analysis of national data.

- Notably, conservation and protection forest reserves exceed the extent of production forest reserves in Central America and Mexico and in Continental South East Asia (Table 1), the reverse of the usual pattern.

- On the whole, there is no very clear relationship between the extent of forest cover and the percentage of land within managed areas in the wildlife sector. The percentage of land within the wildlife sector generally lies in the range 5-10%, irrespective of the percentage of forest cover (compared to a range of roughly 0-5% in the forest sector). This is not particularly surprising, as the aim of protected areas systems is to cover all habitat types, and not just forests.

- The graphs suggest that the sub-region with most opportunity for improvement of forest protection in the wildlife sector is Continental South-East Asia, where % coverage is low in the wildlife sector but high in the forestry sector, and where forest levels are high.

Figure 4. Percent of land forested against
percent of land within designated areas - forest sector

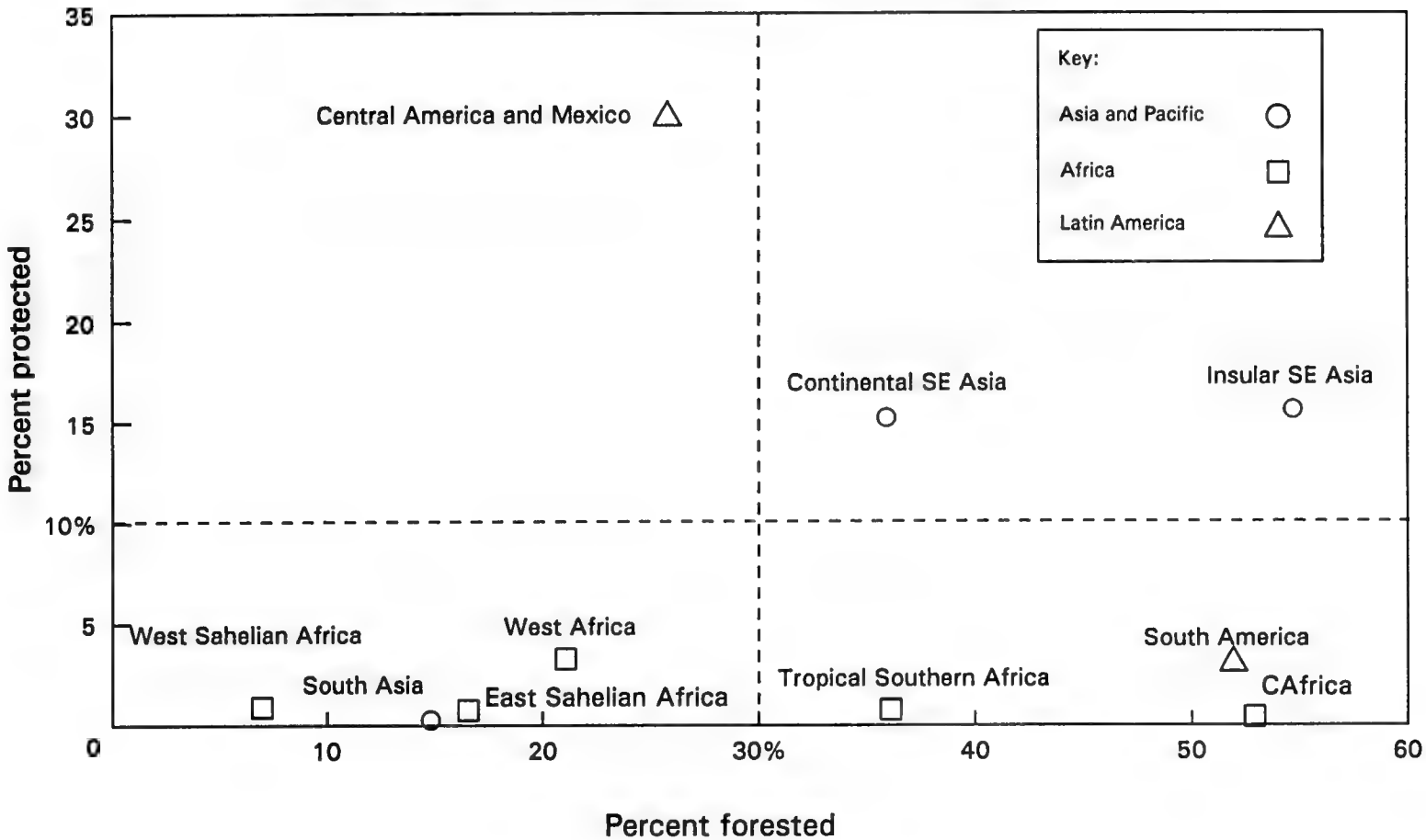
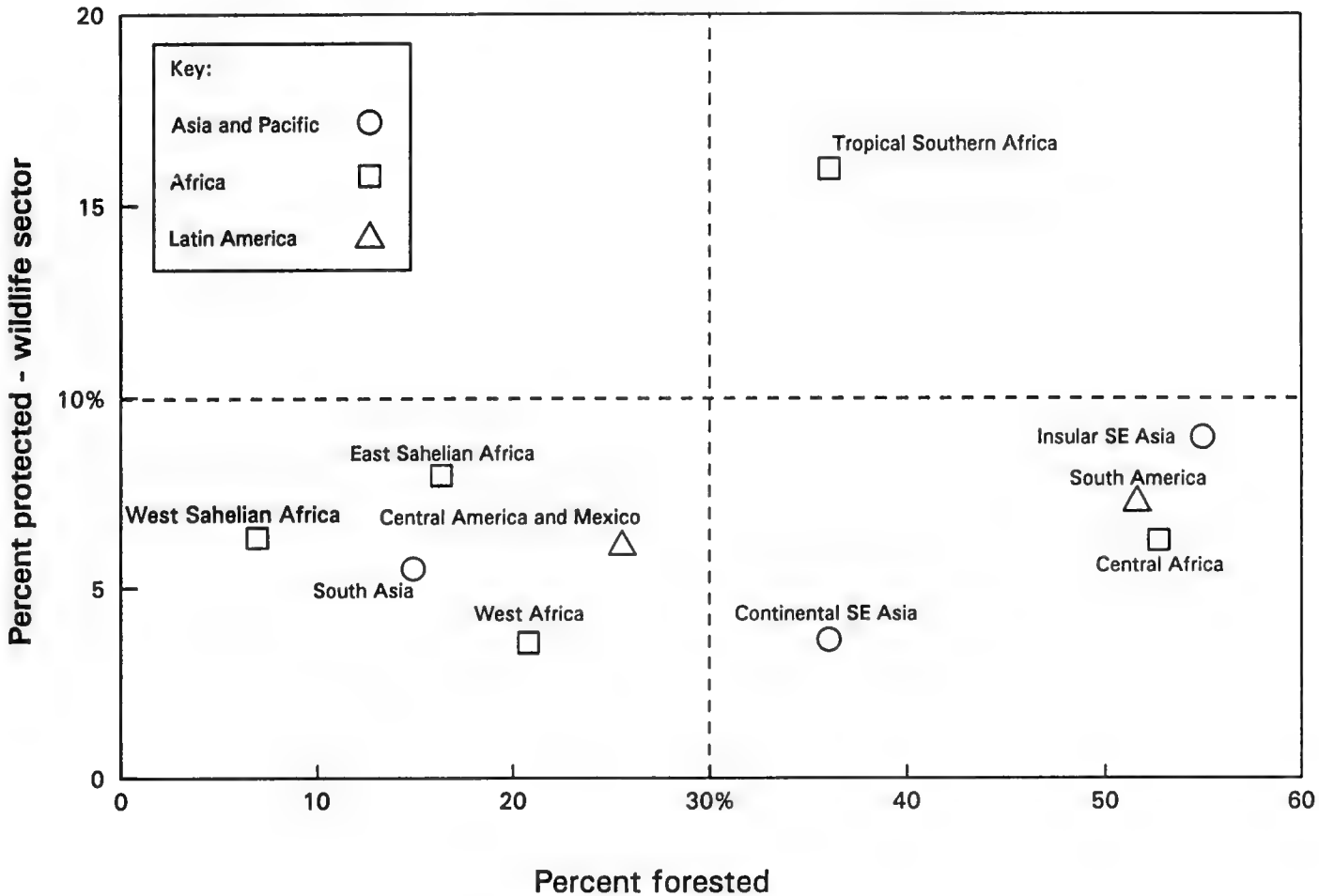


Figure 5. Percent of land forested against
percent of land within designated areas - wildlife sector



4.5 Ecofloristic zone analysis

As described earlier, mapped information on conservation areas in forest and wildlife sectors was overlaid onto maps of Ecofloristic zones, to allow an analysis of distribution. Africa has been selected here as an example and Figure 6 (Ecofloristic zones of tropical Africa - major zones) shows a map of these zones.

- The figures for each zone in tropical Africa are given in Table 3, which underlines again the low level of protection in forest reserves in Africa.

- The percentage of each ecofloristic zone protected varies widely, from 2.6% (thickets, pseudo-steppe and deserts) to as high as 40.8% (alpine vegetation) clearly indicating need for further protection in certain zones.

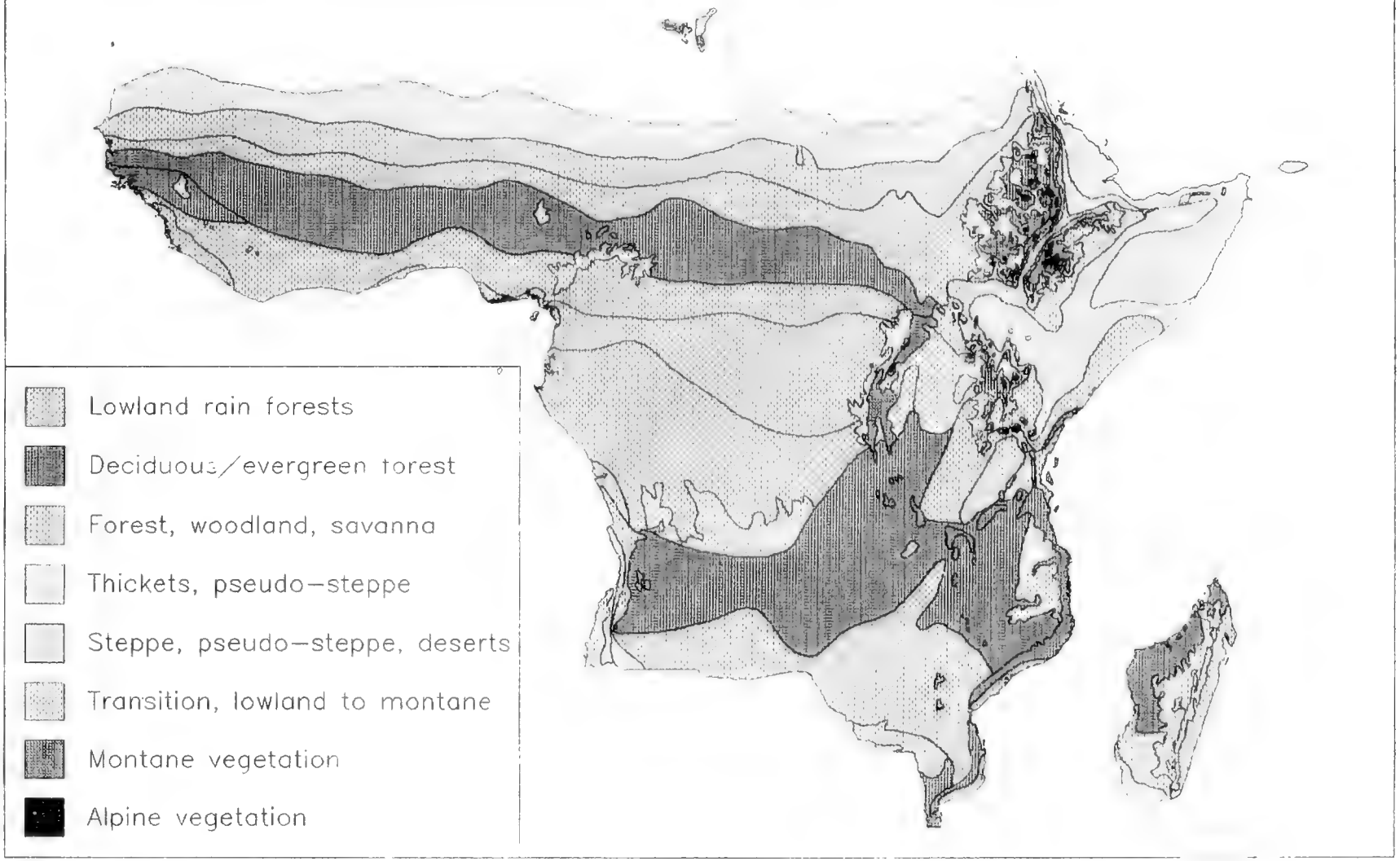
However, the resolution of this table is coarse, and the aggregated data for each zone disguises considerable variation between subzones. The map and table for wet deciduous/evergreen forest indicate a total of 9.2% protection. See Figure 7 (Ecofloristic zones of tropical Africa - degree of protection in the wet deciduous/dry evergreen forest zone) and Table 4, which provide a further breakdown for this zone.

- The extent of protection within this zone varies widely, from 1.5% to 11.6%. A range of factors are likely to contribute to this, including political and socio-economic factors as well as practical conservation concerns.

- Those areas marked red on the map are of higher concern for increasing the conservation areas networks, and the analysis needs to be extended to identify all of these regions. This could be combined with analysis of available support.

Ecofloristic zones of tropical Africa

Major zones



Ecofloristic zones of tropical Africa

Degree of protection in the Wet deciduous/dry evergreen forest zone

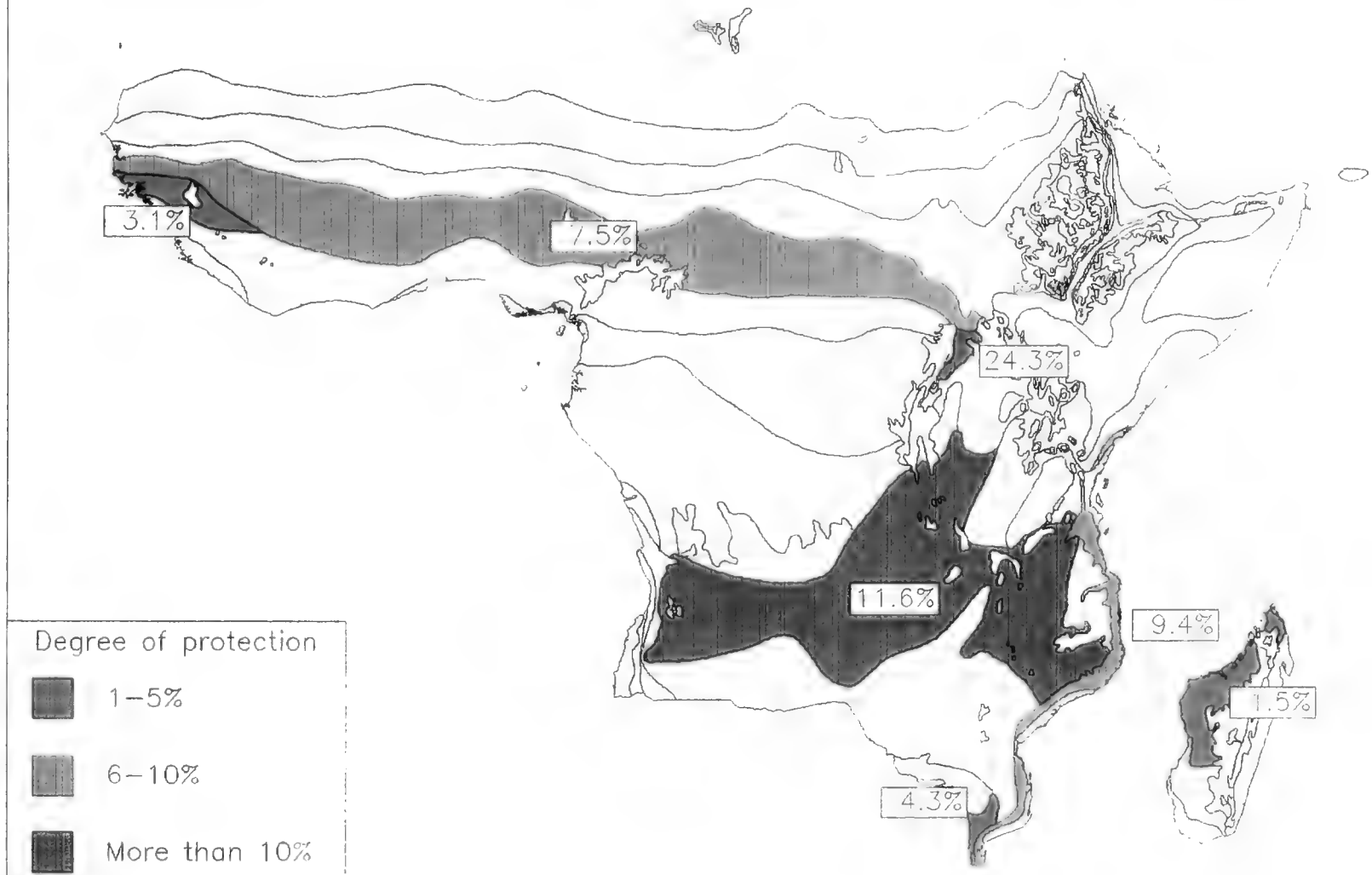


TABLE 3. SUMMARY ECOFLORISTIC ZONE ANALYSIS – Tropical Africa

Ecofloristic zone	Area (Sq.km)	Percent protected: Forest 'sector	Wildlife sector	Total
Thickets and pseudo–steppic vegetation	2,098,887	2.6	0	2.6
Steppe, pseudo–steppe and deserts	4,377,102	2.6	0	2.6
Lowland rain forest	3,965,666	4.2	0.7	4.9
Transition from lowland to montane vegetation	1,403,275	6.8	0.4	7.2
Wet deciduous/dry evergreen forest	4,291,818	8.3	0.9	9.2
Low deciduous forest, woodlands and savanna	2,128,107	9.2	0.2	9.4
Montane vegetation	413,202	8	2.5	10.5
Drier deciduous forest, woodlands and savanna	2,854,207	12.8	0.1	12.9
Alpine vegetation	28,963	35	5.8	40.8
Regional total	21,561,227	0.4	6.5	6.9

TABLE 4. DEGREE OF PROTECTION IN THE WET DECIDUOUS/DRY EVERGREEN FOREST ZONE OF TROPICAL AFRICA

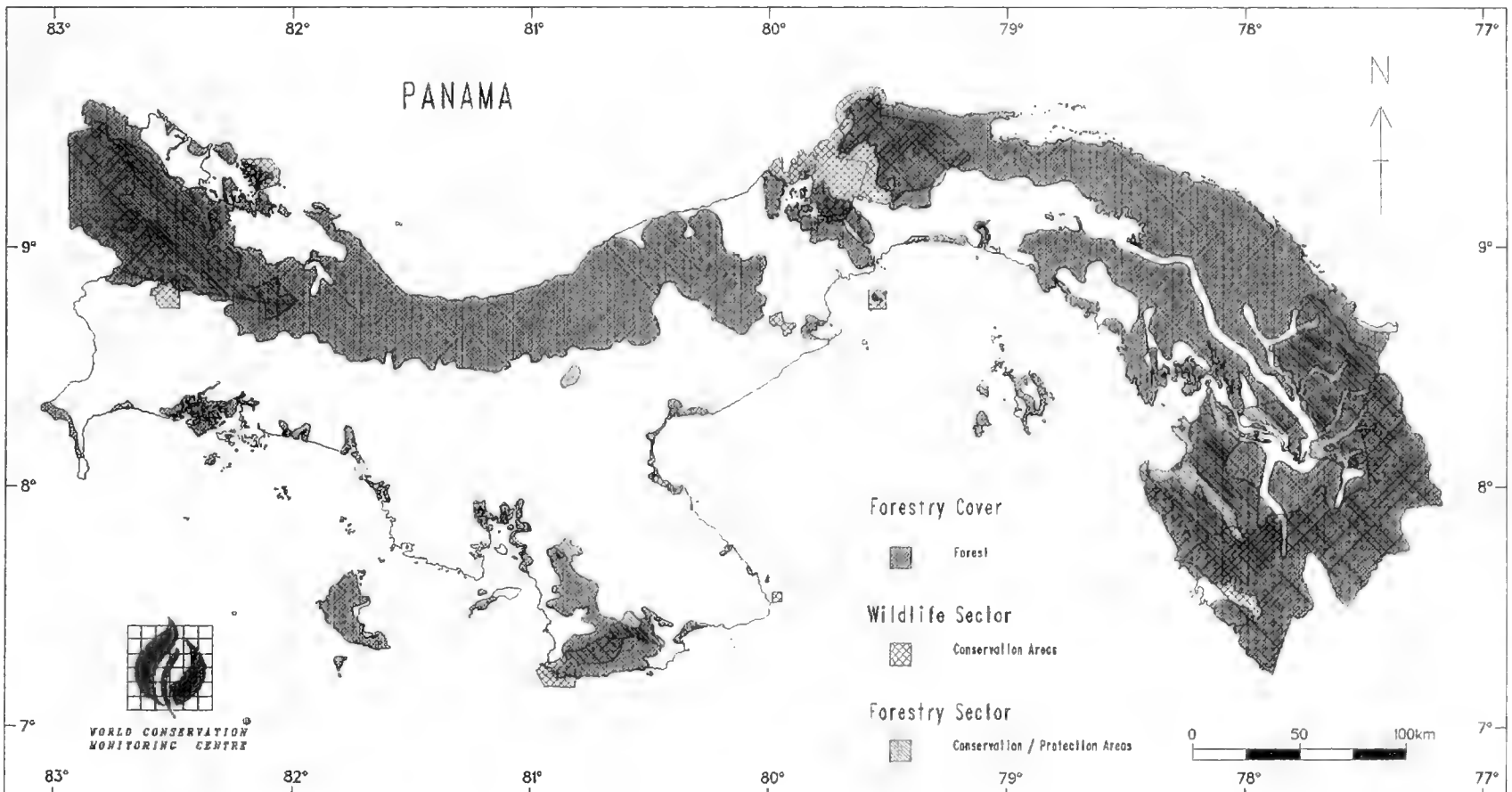
Ecofloristic Subzone	Area (Sq.km)	Percent protected: Forest 'sector	Wildlife sector	Total
Subzone 9	121,996	2.6	0.5	3.1
Sunbzone 10	1,773,671	1.8	5.7	7.5
Subzone 11	34,173	0	24.3	24.3
Subzone 12	170,662	1.5	0	1.5
Subzone 13	1,967,936	0.1	11.5	11.6
Subzone 14	32,457	0	4.3	4.3
Subzone 14	190,925	0	9.4	9.4
TOTAL	4,291,820	0.9	8.3	9.2

4.6 Map-based analysis of forest cover.

The mapped data compiled as part of this project can be overlaid on to forest maps compiled and digitize as part of another WCMC project to map forest cover. Figure 8 (Panama) shows the combined data mapped for Panama. (Note that the forest cover depicted in this map is generalised and is not a precise representation. However, the data are adequate for the purposes of demonstration).

- Data is available to carry out similar analysis for most tropical countries, but such an analysis was not part of this project, and would require separate funding.

- Overlaying data sets on actual forests cover, and the distribution of designated areas, it is possible to calculate the percentage of habitats within protected areas. Analysis of this data shows that nearly 40% of remaining forest cover in the country is included within conservation areas of either the forest sector or wildlife sector, with 15% of forest protected with conservation or protection forest reserves and 23.6% in the wildlife sector areas.


PANAMA
83°
82°
81°
80°
79°
78°
77°
9°
8°
7°
N
Forestry Cover
Forest
Wildlife Sector
Conservation Areas
Forestry Sector
Conservation / Protection Areas
0
50
100km
WORLD CONSERVATION
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4.6 Initial review of protected areas species inventories

- Concern was raised during the project that there was a paucity of baseline inventory data on protected areas. In order to begin assessment of the extent to which this is true, WCMC files were reviewed for protected areas species inventories, and some of the results of this survey are presented in Table 5. The data indicate the number of protected areas that have been surveyed for each of the taxonomic groups, and this is expressed as a percentage of the number of protected areas in each region. Note that the regions are defined somewhat differently in this exercise compared to the WCMC *Tropical Managed Areas Assessment*.

- Of the 8,715 tropical protected areas recorded in the WCMC *Protected Areas Database*, only about 5% appear to have been the subject of floral or faunal inventories, known to WCMC or available at WCMC.

- The best recorded taxonomic groups were birds (3.72%) and, mammals (3.11%), followed by higher plants (1.82%), reptiles (1.14%), trees (1.01%), amphibians (0.70%), freshwater fish (0.47%) and butterflies (0.40%).

- The information available to WCMC is more extensive for the Asia and Pacific regions.

This review was carried out as a pilot project not only to assess the availability of information, but also the potential value of the lists in assessing biodiversity conservation and the costs of collecting and managing the information. The report of this pilot project identifies a number of recommendations.

TABLE 5.4 Number and percentage of protected areas where species inventories have been carried out.

Taxonomic group	Africa Number of inventories	%	Asia/Pacific Number of inventories	%	Latin America Number of inventories	%	Total Number of inventories	%
Butterflies	20	0.79	12	0.47	3	0.12	35	0.40
Freshwater fish	13	0.51	21	0.83	7	0.29	41	0.47
Amphibians	18	0.71	25	0.98	18	0.75	61	0.70
Trees	31	1.22	50	1.97	7	0.29	88	1.01
Reptiles	30	1.18	43	1.69	26	1.08	99	1.14
Higher plants	40	1.06	93	3.66	26	0.30	159	1.82
Mammals	109	4.29	129	5.07	33	1.37	271	3.11
Birds	96	3.78	186	7.31	42	1.74	324	3.72
No. of protected areas in each region	2543		3759		2413		8715	

NB Analysis based only on those inventories of which WCMC is aware.

4.7 International Initiatives

Active national participation in international conventions and programmes is often an important indicator of national commitment to international conservation objectives, and can help ensure international support (sometimes financial) for national conservation priorities. Table 6 provides basic information on compliance with the World Heritage and Ramsar (Wetlands) Conventions, and participation in the UNESCO-MAB Biosphere Reserve Programme. Note that data provided in the Tables is correct as of June 1992.

- Some 66 of the countries listed in Annex 1 have signed the World Heritage Convention, while significantly fewer have acceded to the Ramsar Convention (30) or participate in the UNESCO-MAB Reserves Programme(38).

- World Heritage is generally a wildlife sector convention, but is occasionally applicable to valuable areas in the forest sector (eg Sinharaja in Sri Lanka).

- The Ramsar Convention promotes the wise use of wetland resources, and gives international recognition and support to such important forested wetlands as the Sundarbans mangrove forest (Bangladesh).

- Biosphere Reserves are intended to be areas where lessons can be learned about the interaction between man and nature. This designation would seem to be particularly appropriate to where there is a conflict between exploitation and conservation, for example the Reserva de la Biósfera de la Amistad (Costa Rica).

TABLE 6. Participation in international conventions or programmes concerning the conservation of natural areas

REGION Subregion	Number of countries in subregion	World Heritage Convention		Biosphere Reserves		Ramsar Convention	
		Signatories	Properties	Pareicipants	Properties	Signatories	Properties
TROPICAL ASIA & PACIFIC							
South Asia	7	6	(8)	2	(3)	4	(17)
Continental South East asia	5	4	(1)	1	(3)	1	(1)
Insular South East Asia	5	3	(2)	2	(8)	0	(0)
Oceania	5	1	(0)	0	(0)	0	(0)
Regional Total	22	14	(11)	5	(14)	5	(18)
TROPICAL AFRICA							
West Sahelian Africa	9	7	(5)	3	(5)	7	(14)
East Sahelian Africa	6	4	(1)	3	(8)	2	(2)
West Africa	8	5	(4)	5	(7)	1	(1)
Central Africa	7	5	(6)	5	(11)	1	(3)
Tropical Southern Africa	11	7	(9)	4	(5)	2	(5)
Regional Total	41	28	(25)	20	(36)	13	(25)
TROPICAL LATIN AMERICA							
Central America & Mexico	8	8	(6)	5	(11)	4	(5)
Caribbean	25	7	(0)	2	(6)	2	(7)
South America	10	9	(7)	6	(13)	6	(8)
Regional Total	43	24	(13)	13	(30)	12	(20)
Grand Total	106	66	(49)	38	(80)	30	(63)

NB Data correct at June 1992

Data indicate the number of states within each subregion and region that are party to the three international conventions or programmes, with the number of sites recognised under each in parenthesis.

5. CONCLUSIONS

The information collected for this project complimented and was carried out in support of the FAO Tropical Forest Resources Assessment 1990. Summaries of this information, in both hard-copy and electronic form, has been used by FAO in the preparation of reports and background papers arising out of their assessment study, and by a wide range of other institutions in support of their own conservation initiatives. Information held by WCMC is readily available and accessible to institutions and individuals who have need for it.

The material generated by the project has also been used in support of a number of other projects and ongoing initiatives within WCMC, including the preparation of the four-volume series *Protected Areas of the World: A review of national systems* (IUCN, 1992), the project *TREES -Provision of Tropical Forest Information*, and the *1993 United Nations List of National Parks and Protected Areas*. These publications are widely referred to by an audience of park planners, decision-makers, conservationists, and educators.

The whole project resulted in the significant expansion and development of the *Protected Areas Database* and the GIS system within the context of the WCMC *Biodiversity Map Library*. Further development of these systems, through initiatives following on from this project will be of particular value to organisations in need of accurate, up-to-date information on the management and sustainable use of forests throughout the world.

The major findings of the TMAA project not only provide important baseline information but lead to a whole host of questions and considerations best addressed by further study and analysis. A number of these major findings are as follows:

- Managed areas within the forestry sector cover at least 10.9% of the tropical region.

- An approximately equal area (6.5%) is assigned to production compared to the combined area assigned to protection (3.0%) and conservation (1.5%).

- Managed areas in the forest, wildlife and additional sectors cover 14.8% of the tropical region, which is a very significant proportion.

- The greatest contribution to the global total comes from Tropical Latin America. The additional sector (mainly indigenous reserves) contribute a little under one-half managed areas network in this subregion, and more than 10% of the entire tropical conservation areas network.

- The wildlife sector in Benin covers 12% of the country, but is found exclusively in the savanna/arid lands in the north of the country; tropical forest areas are not included. The forest sector (12.2%) has a more even distribution.

- This comparison also shows that simple statistics alone do not provide the full picture. Managed areas must be systematically mapped for comprehensive systems analyses to be carried out.

- The data may suggest that increased forest cover is associated with increased extent of production forest reserves. However, this is not the case in Central Africa and South America.

- Notably, conservation and protection forest reserves exceed the extent of production forest reserves in Central America and Mexico and in Insular South East Asia, the reverse of the usual trend.

- On the whole, there is no very clear relationship between the extent of forest cover and the percentage of land within wildlife areas. The percentage of land within the wildlife sector generally lies in the range 5-10%, irrespective of the percentage of forest cover, whilst conservation and protection forest reserves cover 0-5% land area.

- Of the 8,715 tropical protected areas recorded in the WCMC Protected Areas Database, only 5% appear to have been the subject of floral or faunal inventories.

- These results highlight a serious 'knowledge gap' in current attempts to conserve biodiversity in a network of protected areas.

6. RECOMMENDATIONS FOR FUTURE ASSESSMENTS

6.1 Scope of the FAO Forest Resources Assessment 1990

As a result of a number of constraints and developments, including a lack of additional funding and inadequate information, the FAO Assessment changed in several respects from what was originally proposed. Changes which directly affected the scope of the WCMC project were as follows:

- The FAO Assessment covered only tropical countries, with the exception of those in Insular Africa (other than Madagascar) and Oceania which were dropped due to paucity of data. Thus, the FAO Assessment ended up covering only 100 of the 130 tropical countries originally identified for inclusion;

- The FAO Assessment was not extended to an additional 30 non-tropical developing countries as originally anticipated because of a lack of further funding; and

- The original intention of producing a series of country briefs was abandoned due to the lack of a comprehensive response from tropical countries to FAO's requests for information.

The WCMC project was necessarily modified in order to maintain consistency with the FAO Assessment. The changes mentioned above, however, indicate important areas for follow-on to the present study. Further, future assessments could be made more comprehensive and more reliable if detailed, site-specific information became available for both wildlife and forestry sectors.

6.2 Ongoing activities

The main phase of the Tropical Managed Areas Assessment project is complete, but a number of concluding activities would be in progress if further funding were available. These are:

- Re-drafting of this *executive summary* for wider circulation. This will serve two purposes: reporting on the project for those who contributed; and advertising the available information for those who might need it. This executive summary should be translated into French and Spanish;

- Wider dissemination of the *full report* to identified individuals and organizations;

- Completion of the *ecofloristic zone analysis* in collaboration with FAO, and publication of the results;

- Preparing *articles and scientific papers* for submission to appropriate meetings and journals. In particular, attention needs to be paid to using the material in land-use planning fora, as well as wildlife/biodiversity fora.

Additionally, thought needs to be given to the possible preparation of a *summary of actions* to draw the attention of IUCN and other organizations to the priorities identified in

preparation of the report, and to identifying what *other materials* might be useful to national and international agencies.

6.3 Future assessments

Given that the project has drawn together a valuable body of information of potential use to both the wildlife and forestry sectors, it is essential that we plan both to use this information effectively, and to develop the database further. The following should form part of a continuing review, and funding opportunities need to be identified.

- *Regular review and update* of the information, which would involve regular contact with wildlife and forestry departments, and the update of maps, files and databases;

- *Extension of the coverage* to developing countries not included in the Forest Resources Assessment 1990 Project (for example Chile and Argentina are the only countries not covered in South America); and

- *Regular analysis* of the available information, and dissemination of the results.

In planning and carrying out future forest assessments, it will also be necessary to extend the work already done on status and distribution of managed areas to review of the actual protection afforded, and the status of management. In particular WCMC will need to address the following:

- *Assessment of forest type and cover* within protected areas in selected countries, to give a basis on which to assess how well the information we are managing reflects protection of forest types on the ground;

- *Assessment of management effectiveness* within protected areas, and assessment of threats to their integrity, to better assess the implementation of designated protected areas; and

- *Assessment of the resources available* for managing areas, looking in particular at staff resources and available funding.

6.4 New projects

Now that the first assessment of managed areas has been completed, the body of information, and the experience gained in compiling it, can be applied to a series of projects that will improve the application and development of future forest resource assessments. Suggested activities include:

- *Analysis of forest cover in the tropics*, using the managed area maps, and maps of forest distribution compiled for other projects, to produce an initial assessment of the coverage of remaining forest areas by managed areas;

- *Review of protected area species inventories*, in order to build a better body of information on what inventories are available. This will make species lists more

accessible, facilitate analysis of species numbers and protected areas, and species distribution within protected areas;

- *Conservation in temperate forests.* An extension of the TMAA project to cover the temperate regions, in order to facilitate assessment of the conservation status of temperate forests; and

- *Mapping production forests.* An extension of the project to more systematically incorporate information on production forests, and possibly plantations. This would facilitate global and regional forestry analyses, supporting the activities of both FAO and International Tropical Timber Organisation.

In addition to the arguments for future assessments and new projects, further funding in support of TMAA would provide a whole host of benefits to the complementary projects which are ongoing and planned at WCMC.

6.5 Strategic Planning

In order to facilitate future development of protected areas work at WCMC, and to ensure that a basis for future assessment is maintained, WCMC has prepared a development strategy for the WCMC *Protected Areas Information Service.* This takes account of each of the above recommendations, drawing the ideas together into a single coherent document. This strategy, and project concepts supporting its implementation are available from WCMC.

Annex 1 List of tropical countries included within the FAO Forest Resources Assessment 1990 project, and hence within the WCMC *Tropical Managed Areas Assessment*

AFRICA

West Sahelian Africa
Burkina
Cape Verde
Chad
Gambia
Guinea-Bissau
Mali
Mauritania
Niger
Senegal

East Sahelian Africa
Djibouti
Ethiopia
Kenya
Somalia
Sudan
Uganda

West Africa
Benin
Côte d'Ivoire
Ghana
Guinea
Liberia
Nigeria
Sierra Leone
Togo

Central Africa
Cameroon
Central African Republic
Congo
Equatorial Guinea
Gabon
Sao Tome & Principe
Zaire

Tropical Southern Africa
Angola
Botswana
Burundi
Malawi
Mozambique
Namibia
Rwanda
Tanzania
Zambia
Zimbabwe

Insular Africa
Madagascar

LATIN AMERICA

Central America and Mexico
Belize
Costa Rica
El Salvador
Guatemala
Honduras
Mexico
Nicaragua
Panama

Caribbean
Anguilla
Antigua and Barbuda
Aruba
Bahamas
Barbados
Bermuda
British Virgin Islands
Cayman Islands
Cuba
Dominica
Dominican Republic
Grenada
Guadeloupe
Haiti
Jamaica
Martinique
Montserrat
Netherlands Antilles
Puerto Rico
Saint Lucia
Saint Vincent & the Grenadines
Saint Christopher & Nevis
Trinidad & Tobago
Turks & Caicos Islands
US Virgin Islands

Tropical South America
Bolivia
Brazil
Colombia
Ecuador
French Guiana
Guyana
Paraguay
Peru
Suriname
Venezuela

ASIA & PACIFIC

South Asia
Bangladesh
Bhutan
India
Maldives
Nepal
Pakistan
Sri Lanka

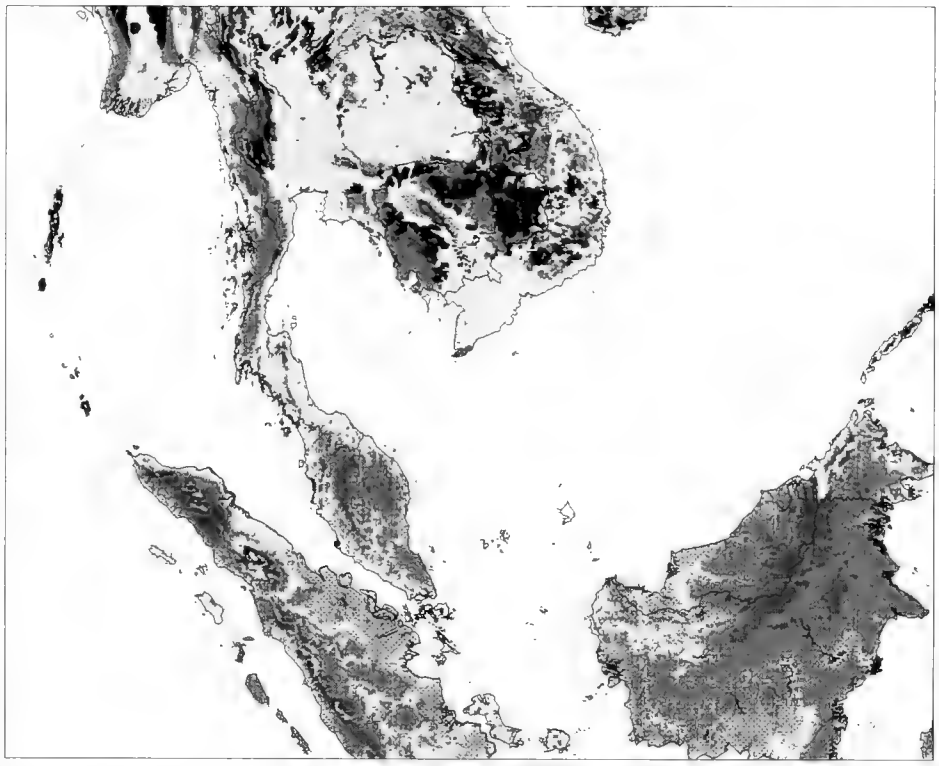
Continental South East Asia
Cambodia
Lao PDR
Myanmar
Thailand
Viet Nam

Insular South East Asia
Brunei Darussalam
Indonesia
Malaysia
Philippines
Singapore

Oceania
Fiji*
New Caledonia*
Papua New Guinea*
Solomon Islands*
Vanuatu*

*Excluded from *FAO Forest Resources Assessment 1990*.

BIODIVERSITY MAP LIBRARY



The World Conservation Monitoring Centre (WCMC) is able to provide maps and supporting information on the Earth's ecosystems, protected areas and threatened species. This Geographic Information System (GIS) gives a new dimension of information needed to achieve conservation in the real world, and forms part of WCMC's core data management facility.

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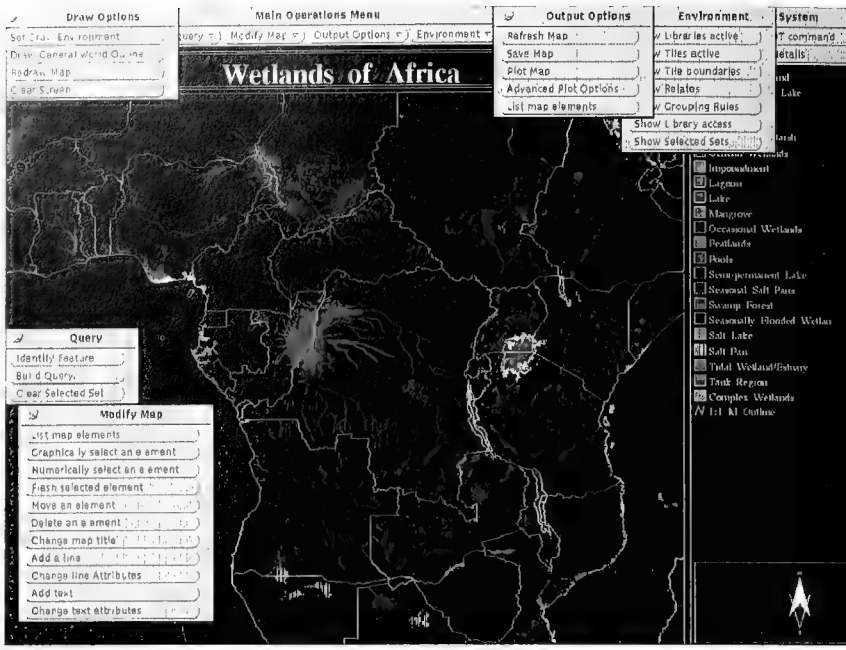
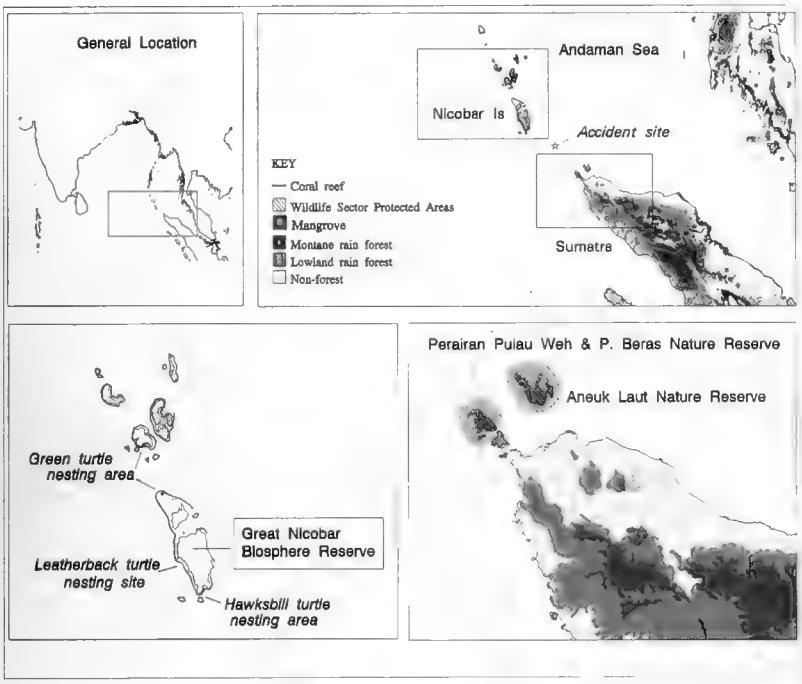
The Biodiversity Map Library (BML) is a rapid response tool developed by WCMC with sponsorship from British Petroleum (BP) to supply geographical information to users who are untrained in GIS techniques. It brings together the most important features of interactive geographic data management under a simple but powerful graphic user interface, allowing users to:

- access WCMC's extensive conservation data holdings
- create, browse, query, and print maps
- insert updated maps and database information
- check the integrity and quality of the data
- display data at national, regional or global scales
- customise maps for individual applications.



The system stores global data at a nominal scale of 1:1 million. Global biodiversity datasets include: protected areas, tropical forests, mangroves, coral reefs, wetlands, sea turtle nesting beaches, endemic bird areas and centres of plant diversity. In addition, complete vegetation maps are available for most developing countries. Other datasets showing topography, global vegetation and ecosystem classifications are also held.



Emergency Response

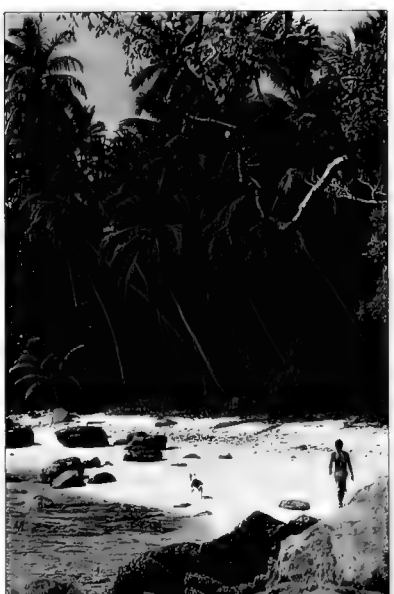
Maps, databases and reports are available on request from WCMC for most areas of the world, documenting important local features of biodiversity. Digital information, including maps as graphics files, can be provided very quickly and despatched via communications networks. Maps can be created within minutes of notification of an incident, showing the important features of biodiversity that are under threat.

Applications of BML

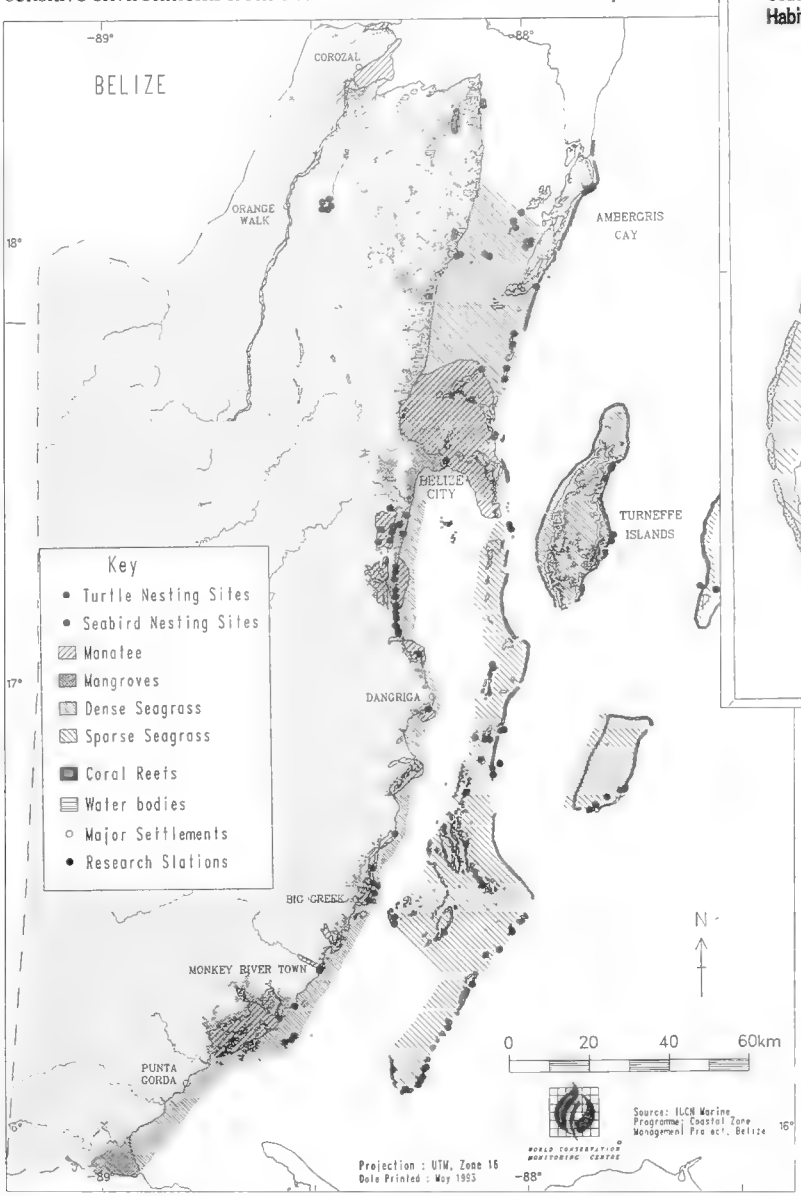
The system serves any application which requires mapped information to be provided in digital or printed form. It has provided new tools for managing large geographic datasets, and is used by WCMC as the core data management facility for georeferenced information. In time, it is envisaged as the main interface through which all of the Centre's datasets will be accessed. It has already been used effectively in 'real time' to deliver information on coastal sensitivity for ***emergency response*** to marine oil spills. The BML is also proving to be useful in ***contingency planning***, allowing users access to a full range of conservation related information at a variety of scales.

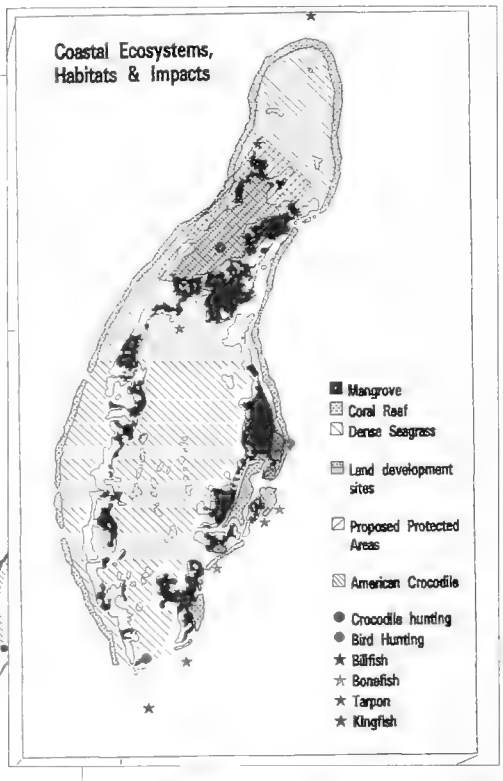
Strategic and Contingency Planning

The BML stores data for use in either regional or local planning activities. The data have already been used by the UN Food and Agriculture Organisation to assess the area of different ecosystems lying within various categories of protected areas. The system has also been proposed to assist in contingency planning for marine or terrestrial pollution incidents, allowing planners, for example, to distribute pollution control resources or to plan the route of a pipeline.



A particular feature of the BML is the ability to integrate details of sensitive environments from both the marine and terrestrial ecosystems.





System Requirements

BML operates within the ESRI ARC/INFO GIS system running on a SUN Unix platform. It will run under any other hardware platform provided it is connected on a Local Area Network (LAN) using X-emulation terminal software and a VGA/SVGA monitor.

For further information please contact:
The GIS Manager, World Conservation Monitoring Centre, 219 Huntingdon Road, Cambridge, CB3 0DL, UK
Telephone 0223 277314, Fax 0223 277136, email gis@wcmc.org.uk

The World Conservation Monitoring Centre is a joint-venture between the three partners who developed the World Conservation Strategy: IUCN – The World Conservation Union, UNEP – United Nations Environment Programme, and WWF – World Wide Fund for Nature (formerly World Wildlife Fund). Its mission is to support conservation and sustainable development through the provision of information on the world's biological diversity.

Development of the BML software was sponsored by The British Petroleum Company plc.

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BP

Annex 3 Ghana chapter from *Protected Areas of the World: A review of national systems* (IUCN, 1992).

GHANA

Area 238,538 sq. km

Population 15 million (1990)
Natural increase: 3.1% per annum

Economic Indicators
GDP: US$ 381 per capita (1987)
GNP: US$ 400 per capita (1988)

Policy and Legislation Conservation of forests and wildlife has a long tradition, which has expressed itself in the creation of indigenous "law" and more comprehensive legislative instruments. Arising from a totemistic belief that people can have a mystical union with plants, animals or natural objects, local practices, customs and taboos have been developed to protect cultural and religious objects or natural areas with particular plant and animal species. The protection of snails in fetish groves in Ashanti Region, Nile crocodile on Katorgor Pond, Paga in Upper East Region and mona, and black and white colobus monkeys at Boabeng-Fiema in the Brong-Ahafo Region, are notable examples. Hunting of these species is prohibited, access and utilisation of their habitats restricted and offences dealt with by the traditional councils (Nuhu, 1986). Further, most of the surviving Southern marginal forest type lies in sacred groves (Hall and Swaine, 1981).

One of the first conservation initiatives was the creation of a number of game reserves by the Forestry Department under the Wild Animals Preservation Ordinance (Cap. 246), 1901. In 1952, the Wild Animals Preservation (Amendment) Ordinance No. 10 was passed, and subsequently revised in 1960, which allowed for the dereservation of a number of game reserves and the extension of game laws (Nuhu, 1986). Shortly thereafter, the 1901 and 1952 Ordinances were repealed with the enactment of the Wild Animals Preservation Act No. 43, 1961, under which the President is empowered to establish reserves. Legislative Instrument 710 of 20 September 1971, repealing the earlier Wild Animals Preservation (Game Reserves) Regulations (L.I. 171), 1962, sets out the wildlife reserves regulations, and provides for the establishment of the first currently recognised reserves, namely Mole, Digya and Bui national parks, Shai Hills Game Production Reserve, Kogyae Strict Nature Reserve and Owabi Wildlife Sanctuary. Legislative Instrument 1283, 1983 deals with penalties for contravention of the 1971 Wildlife Conservation Regulations. In establishing forest reserves and conservation areas, the land must be compulsorily acquired by the government and compensation paid to the owner (Owusu *et al.*, 1989).

Definitions for national park, strict nature reserve and wildlife sanctuary do not appear in either the 1961 Act nor the 1971 Regulations, but are defined and recognised as set out in the Africa Convention of 1968 (Annex). Further, as this Convention makes provision for countries to create their own special categories of reserve, the definition of game production reserve is set out in the 1974 Wildlife Conservation Policy (Asibey, pers. comm., 1991). New definitions for the various categories have, however been drawn up for incorporation into the 1961 Act (Annex). In practice, both strict nature reserves and wildlife sanctuaries are protected in the same way as national parks. Management objectives have been to plan and systematically open all national parks to recreational (tourism) use, with game production reserves utilised for compatible forms of use that do not have major adverse effects on wildlife (Asibey, pers. comm., 1991).

Under the national Wildlife Conservation Policy of 9 January 1974, the importance of protected areas in conserving "representative samples of the wildlife resource" is emphasised and this is to be supported by research and scientific management. Conservation of wildlife within parks and reserves overrides all other interests and non-compatible uses are not permitted. Culling may be allowed if there is a danger of overstocking or if one animal population threatens the conservation of another. Within the policy, a distinction is made between the function of game production reserves and other protected areas. Non-native animals may be introduced into game production reserves for meat production or sport. Game production reserves may also be used for such compatible purposes as the capture of animals for educational use, research or sale, and logging may be permitted (Department of Game and Wildlife, 1974).

Following World War I, efforts to curb deforestation involved the creation of forest reserves under native authority bye-laws. A forest policy was also adopted with a view to "conserve sufficient areas of forest" to protect the forest ecosystem (Bennuah, 1987). Lack of public support for both measures prompted the Governor of the Gold Coast to pass the Forest Ordinance of 30 March 1927 (Cap. 157). This Ordinance allows for the constitution of forest reserves (Annex), provides for the appointment of a Reserve Settlement Commissioner, and sets out the procedure involved in notification. Ownership of land is not altered by the creation of a forest reserve and it may be managed either by the owner under direction from the Forestry Division or by the Government for the benefit of the owner. The Concessions Act No. 124, 1962 amends these provisions and establishes that all forest reserves are deemed to be vested in the President acting in trust for the customary land owners. It also abolished the creation of forest reserves under local bye-laws (EPC, 1989). By virtue of the Forest Ordinance, the President may, by order published in the *Gazette*, direct that land cease to be considered a forest reserve. The Ordinance also sets out offences and penalties and matters dealing with the management of forest reserves.

The Trees and Timber Decree (NRCD No. 273) of 23 August 1974 deals, *inter alia*, with areas outside forest reserves (Annex). The Forest Reserve Commissioner is able to designate and withdraw areas as protected areas, as well as make regulations which impose duties on persons who hold concessions in such areas, allow for the appointment of forest guards and make provisions for the payment of fees by concessionaires.

The Forest Policy of 1948 encourages the creation of sufficient permanent forest resources by reservation of appropriate areas of forest or land suitable for afforestation, allows for the protection of wildlife, and recognises the damage which unregulated and unplanned mining of forest resources can bring to the ecology and environment (Bennuah, 1987; World Bank, 1988). The draft national forest policy (1989) focuses on the overall management of the forest estate to ensure sustainability of forest resources and environmental conservation. Key provisions include: protection of soil and water resources; protection of water catchment areas; conservation of flora and fauna; control of desertification; and controlled exploitation of forest resources based on the principles of sustainable yields, environmental conservation, and enhancement of biodiversity (Tufour, 1990).

Two of the major shortcomings of current protected areas legislation are: an emphasis on preservation of useful animals as opposed to the conservation of all wildlife; and a lack of provision for conservation beyond the reserve network (EPC, 1989; World Bank, 1988). Amendments to the Wild Animals Preservation Act No. 43, 1960, proposed to be renamed the Wildlife Conservation Act, are intended to address these shortcomings (Kamugasha, 1989; World Bank, 1988).

A weakness of current forest policy and legislation is an absence of any perceived permanent role for trees on land outside of reserved forests (EPC, 1989; World Bank, 1988). Consequently, trees have been used but not replaced on land outside the reserve network, and such land has subsequently been converted to other forms of use. This issue, along with a number of others, are being considered in the revised national forest policy.

International Activities Ghana is party to a number of international conventions concerned with protected areas, namely the Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) ratified on 4 July 1975, and the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) acceded to on 22 February 1988. To date, no natural sites have been inscribed on the World Heritage List, while one wetland is listed under the Ramsar Convention. Ghana participates in the Unesco Man and the Biosphere (MAB) Programme, under which one biosphere reserve was approved in 1983. At a regional level, Ghana ratified (1968) the African Convention on the Conservation of Nature and Natural Resources (African Convention), which establishes several categories of protected area.

Administration and Management The mandate for wildlife conservation and protected areas management lies with the Department of Game and Wildlife, Ministry of Lands and Natural Resources. Initially, matters relating to wildlife conservation came under the jurisdiction of the Forestry Department, which was responsible for administering the Wild Animals Preservation Ordinance of 1901. In 1949, proposals for the organisation of a game department were pre-empted due to a lack of staff and funds (Asibey, 1970). In 1953, responsibilities for game preservation were handed over to the Tsetse Control Department, ironical in view of the Department's active support of a programme of wild animal extermination to control tsetse fly over the previous 20 years (Nuhu, 1986). In 1957, the Tsetse Control Department was abolished and responsibility for game preservation returned to the Forestry Department (Asibey, 1970). In 1965, the Game Branch of the Forestry Department became the Department of Wild Animals Preservation and, in 1967, the Department of Game and Wildlife was formed.

The Department of Game and Wildlife is headed by a Chief Game and Wildlife Officer, under whom are three deputies in charge of the Administration, Research and Management divisions, respectively. The Management Division is divided into four sections: (1) zoological gardens; (2) general wildlife; (3) national parks; and (4) game production reserves, wildlife sanctuaries and strict nature reserves. Matters relating to wildlife conservation outside reserve areas fall within General Wildlife Conservation Services. The Department has four main personnel levels: professional, senior technical, technical, and sub-technical. Including about 400 subordinate employees (labourers, artisans, drivers), the total staff complement is around 1000 (Clarke, 1991). Reorganisation and strengthening of the Department is proposed under the Forest Resource Management Project and the World Bank (IBRD)/IUCN/Government of Ghana (GOG) Programme (Clarke, 1991; World Bank, 1988). Resources have also been allocated to upgrade the Mole Wildlife School for in-service training on wildlife and protected areas management.

Management and protection of the forest estate is the responsibility of the Forestry Department, Ministry of Lands and Natural Resources. First established in 1909, closed in 1914 due to World War I, reorganised in 1919 and again closed during World War II, the Forestry Department came under the Forestry Commission in 1980 and was then transferred to the Ministry of Lands and Natural Resources in 1982 (Bennuah, 1987). Under the Forest Resource Management Project, it is proposed to reorganise the Forestry Department to include a Chief Conservator of Forests and four deputies in charge of 1) administration and finance, 2) development, management and working plans and rural forestry, 3) research, 4) education and training, respectively. There would also be a Planning and Monitoring Unit.

The work of the Forestry Department would be divided into nine forest regions comprising 42 forest districts (World Bank, 1988).

The Forestry Commission, created in 1980 under the Ghana Forestry Commission Act No. 405, initially had jurisdiction over the Game and Wildlife and Forestry departments. Its responsibilities under the Provisional Defence Council (PNDC) Proclamation Law of 1982 have since become primarily advisory, and include formulating recommendations on forestry and wildlife policy.

The Environmental Protection Council, Ministry of Local Government, created under the Environmental Protection Decree (NRC Decree No. 239) of 1974, coordinates and advises on environmental matters, including those related to wildlife conservation. It is also responsible for coordinating environmental impact assessments "on all developments/industrial projects to include the possible effects of such projects on wildlife", and is currently preparing an Environmental Action Plan (EAP) with assistance from the World Bank, US-AID and ODA (Adzobu, 1990; EPC, 1989). The areas of concern addressed in the EAP are land management; forestry and wildlife; marine and coastal ecosystems; human settlements; and legal, educational and institutional issues, among others. The Council is headed by an executive chairman and there are two main departments, namely, Administration and Programmes. The Programmes Department is headed by a director who oversees four divisions: development planning; natural resources management; monitoring and assessment; and information and education. In addition, the EPC operates in the regions through its regional offices (Adzobu, 1990).

The Ghana Association for the Conservation of Nature (GACON), in conjunction with Harrogate Conservation Volunteers, UK, was established in June 1988. According to its constitution, one of the objectives is the "establishment of local reserves of natural forests presently serving as sacred groves, burial grounds and waters" which are to be "managed by the local community". One notable example is Jachie Conservation Area in the Ashanti Region. Declaration of this land as a sacred area for the citizens of Jachie was to fulfil the dual function of protecting an important burial ground and to serve as a refuge for local plants and animals. Other village-level wildlife reserves which have been set up are at Kokobiriko, Asienimpong and Santasi (Frimpong-Mensah, pers. comm., 1990).

There are a number of constraints to protected areas management. Staffing and recruitment, especially at the professional and senior technical grades, have been persistent problems. Within the Department of Game and Wildlife, 18 of 76 posts at the professional level, 17 of 36 positions at the senior technical grade, 19 of 66 posts at the technical level, and 175 of 394 positions within the sub-technical category were filled (Clarke, 1991). Similarly, vacancies are currently at 66% of the professional category posts, 54% at the semi-professional level, 43% among technical officers and 3% at sub-technical level within the Forestry Department (World Bank, 1988). In both departments, lack of funds has severely restricted management programmes, including the control of concession operations in the case of the Forestry Department. Other constraints include poor remuneration, unsatisfactory living and working conditions in the field, a lack of training opportunities, and in the case of the Department of Game and Wildlife, a lack of management plans, inadequate boundary demarcation, and a lack of scientific data upon which to base management decisions (Clarke, 1991). Substantial resources are being allocated through the Forest Resource Management Project and the IBRD/IUCN/GOG programme to revitalise the functions of these two departments.

Systems Reviews Ghana is bordered by Côte d'Ivoire to the west, Burkina Faso to the north, Togo to the east, and the Gulf of Guinea to the south. The country is in a flat and relatively low-lying area, with altitude mainly below 200m, although there are some inland hill ranges up to 450-900m. Much of Ghana lies within the drainage system of the Volta River and its tributaries (Ankudey and Ofori-Frimpong, 1990).

The biogeographic affinities are Guinea-Congolian in the south-west, Sudanian in the north, with Guinea-Congolian/Sudanian regional transition zone in the centre and south-east (Stuart and Adams, 1990). Two ecological zones recognised are closed forest, occupying 8.22 million ha or 34% of total land area, and savanna covering 15.62 milllion ha or 66% (Owusu *et al.*, 1989). Both zones support a number of endemic plant and animal species, the majority of which are found in closed forest. In 1988, the major forms of land use were: forest reserves (11%), wildlife reserves (5%), unreserved closed forests (2%), unreserved savanna woodlands (30%), cultivated tree crops (7%), cultivated annual crops (5%), unimproved pasture (15%), and bush fallow and other uses (25%) (Owusu *et al.*, 1989). Agricultural land in both the savanna and closed forest zones is continually expanding due to the rapid increase in the human population (World Bank, 1988).

At the turn of the century it was estimated that Ghana had 88,000 sq. km of forests, occupying 35% of total land area. By 1950, this had fallen to 42,000 sq. km, and by 1980 it was estimated that forests covered about 19,000 sq. km in the savanna and closed forest zones (Frimping-Mensah, 1989). The current area of intact closed forest is about 15,000 sq. km, and the current deforestation rate in this zone may be considered negligible, as very little closed forest remains outside the reserve network (Bird, pers. comm., 1991).

Desertification, largely a result of deforestation, is of growing concern in arid and semi-arid areas. It has been estimated that approximately 35% of land area is subject to desertification (UNSO, 1982).

The wetland system includes coastal lagoons, estuaries, mangrove stands, tidal saltmarshes, swamp forests and inland rivers and lakes. Inland water areas occupy approximately 11,800 sq. km., with Lake Volta accounting for 0.85 million ha (Owusu *et al.*, 1989). Along the 550km coastline are an estimated 50 lagoons, many of which are less than 0.5 sq. km (Gordon, 1987). Mangroves are best developed on the western coast, between Côte d'Ivoire and Cape Three Points (Hughes and Hughes, 1991). Currently, mangroves remain unprotected and are faced by a number of threats. One conservation initiative currently underway, however, is a joint venture between the Royal Society for the Protection of Birds (RSPB), International Council for Bird Preservation (ICBP) and the government of Ghana (GOG) in the protection of seabirds and shorebirds and their habitats (Hepburn, 1987). Entitled "Save the Seashore Bird Project", this is one step towards ensuring the protection and sustainable use of the coastal wetland ecosystem.

Concern for deforestation dates back to the beginning of this century with the passing of the Timber Protection Ordinance in 1907 and an assessment of the forest estate by H.N. Thompson. Game reserves were subsequently established in 1909, while the selection, demarcation and constitution of forest reserves in the closed forest area commenced in 1919 (Asibey, 1978; Ghartey, 1990). Following the passing of the Forest Ordinance of 1927, reservation was pursued vigorously and by 1939, 1.6 million ha of closed forest had been constituted as forest reserves (Ghartey, 1990). The protected areas network, including protection and production forest reserves and conservation areas, currently covers 16% of land area, of which natural protection forest reserves account for 0.6% and wildlife sector reserves 5% (Forestry Department/Commission, pers. comm., 1990; Owusu *et al.*, 1989). Of the approximately 280 forest reserves in the country, 180 serve a production function while 100 are considered to be protection reserves (Forestry Department/Commission, pers. comm., 1990). Production forests are managed under production, protection and research working circles. In the closed forest zone, approximately 1.1 million ha is assigned to the production working circles and 0.4 million ha to the protection working circles (Ghartey, 1989).

No national review of the protected areas system has been conducted, but certain priorities to develop the existing network are identified in MacKinnon and MacKinnon (1986), IUCN (1987), and Stuart and Adams (1990). At present, the upland evergreen forest is not represented within the protected areas system, while the inner zone of the semi-deciduous forest type is minimally protected (Hall and Swaine, 1981; IUCN, 1988). A further deficiency is the small size of protected areas in the forest zone (Hall and Swaine, 1981). Despite the fairly extensive system of protected areas, 91% of the area covered by wildlife sector reserves occurs in degraded habitats such as savanna/woodland (Owusu *et al.*, 1989). To help address this deficiency, Kakum National Park and Assin-Attandaso Game Production Reserve are being proposed for the Central Region, and Agumatsa Wildlife Sanctuary for the Volta Region (Dudley, pers. comm., 1990; Punguese, pers. comm., 1990). A further initiative includes a study of protected areas development in the south-west funded by the Delegation of the Commission of the European Communities (EC) in Ghana (Nagel, pers. comm., 1990). In addition, the Environmental Protection Council is currently supporting preliminary research into sacred groves and the contribution of this form of community-based protection to the protected areas system (Omari, pers.comm., 1990). In contrast to wildlife sector reserves, only 5.6% of the savanna woodland area is in gazetted forests, prompting recommendations to intensify forest reserve creation in this habitat for environmental protection and to stem the southward encroachment of the Sahel (Tufour, 1990).

Under the Forest Resources Management Project, the forestry and wildlife sectors are being reviewed, with the aims of consolidating the present network of protected areas, and improving management both within protected areas and outside them (Howard, 1989; World Bank, 1988). Additionally, the government is engaged in the preparation of a National Forest Strategy Statement which will identify actions to be undertaken and a schedule for their implementation (World Bank, 1988). The Forestry Commission is to play a significant role in reviewing and advising in both of these initiatives. Complimenting the Forest Resources Management Project is the IBRD/IUCN/GOG Programme aimed at strengthening the Department of Game and Wildlife's management of protected areas. This programme, which is to run for four years (1991-1994), has included among its components: institutional development; protected area development; and an environmental awareness programme. The programme will also provide for a review of wildlife and protected area policy, and an assessment of wildlife and protected areas legislation (Clarke, 1991).

Threats to forest reserves include: over-exploitation by concessionaires, particularly of the better-known species; illegal felling; extraction of fuel wood; uncontrolled bushfires, especially in the savanna and semi-deciduous zones; mining activities in some locals; and agricultural encroachment. Poaching of wildlife, conflicts with local citizens and other departments and institutions, and unresolved resettlement issues are problems within the wildlife sector (Nuhu, 1986; Owusu *et al.*, 1989; Stuart and Adams, 1990; World Bank, 1988).

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ANNEX
Definitions of protected area designations, as legislated, together with authorities responsible for their administration

Title: Wild Animals Preservation Act (No. 43)

Date: 1961, last amended 1971

Brief description: Provides for the protection of fauna and flora

Administrative authority: Department of Game and Wildlife (Chief)

Designations:

Reserve

Includes national park, game production reserve, strict nature reserve and wildlife sanctuary.

Entry is by consent of the Chief Game and Wildlife Officer and conditions for entry are determined by him.

It is unlawful to hunt, capture or kill any bird or wild animal, or to collect or destroy any plant except for conservation or management purposes with the consent of the Chief Game and Wildlife Officer.

Other activities prohibited include: the setting of fires; pollution of water; littering; entry with equipment for the purposes of hunting; and the clearing or cultivating of land without written consent.

National park (proposed definition) Area under state control set aside for the propagation, protection, and conservation of wildlife and vegetation, and the ecological stability of wildlife and plant communities.

Other functions include the protection of sites, landscapes or geological formations of scientific or aesthetic values for the enjoyment, education and inspiration of the general public.

Prohibited activities are the hunting, killing and capture of animals, and the destruction and collection of plants and other forms of vegetation except for scientific and management purposes authorised by the minister.

Strict nature reserve (proposed definition) Area under state control for the exclusive protection of floral and faunal resources. Any conflicting activies or land uses are prohibited.

Prohibited activities include any form of hunting, fishing, any development related to forestry, agriculture or mining, grazing, excavation, prospecting, drilling, levelling of the ground or construction, any work which alters soil structure or vegetational character, any form of pollution, and any act which harms or disturbs the fauna or flora, including the introduction of indigenous or imported, wild or domesticated zoological or botanical species.

Wildlife sanctuary (proposed definition) Area set aside by the state to protect characteristic wildlife, especially migratory bird communities, or to protect threatened animal or plant species.

Any forms of hunting, killing or capturing of any wildlife are prohibited except for scientific research authorised by the minister.

Game production reserve (proposed definition) Area set aside by the state for the conservation, management and propagation of wildlife and its habitat.

Other state controlled land use forms compatible with wildlife conservation may be practised. (This has traditionally included logging.)

Sources: Original legislation; Kamugasha, 1989

Title: Forest Ordinance (Cap. 157)

Date: 1927, last amended in 1986 (PNDCL 142)

Brief description: Allows for the establishment of reserves and sets regulations governing the use and management of forest resources.

Administrative authority: Forestry Department (Chief Conservator of Forests)

Designations:

Forest Reserve

Any government, tribal, stool, private lands or lands deemed to be in need of protection may be constituted as forest reserves by the President inclusive of all limits and rights.

An order, six months following notification in the gazette and known as the date of reservation, brings forest reserves into operation.

Activities prohibited include: farm cultivation, setting of fires, hunting of wildlife, and damage to trees.

In practice, forest reserves and associated areas are defined as follows:

Sacred grove Protected area inside or outside a forest reserve to ensure that the fetish or sacred character of the grove is respected.

Local bye-laws, customs, rites and taboos govern its use and protection.

Production forest Reserve areas which support sustained production of timber and other forest products.

Constitution and prohibited activities as outlined in Forest Ordinance.

Protection forest Reserve area where extraction of timber is usually forbidden, but limited exploitation may be permitted in accessible areas.

Established and managed for the protection of steep slopes and water catchment areas in all or part of a forest reserve.

Constitution and prohibited activities as outlined in Forest Ordinance.

Private forest Small plantation or woodlot established and owned by villages, communities, schools or institutions to meet local fuel wood and pole requirements.

Local restrictions on use apply.

Amenity forest Localised planting of trees owned and managed by individuals, communities or institutions to provide for shade, shelter and beauty (e.g. avenue planting).

Community laws govern its use and management.

Sources: Original legislation; Forestry Commission, pers. comm., 1990

Title: Trees and Timber Decree (NRCD No. 273)

Date: 23 August 1974

Brief description: Allows for the protection of land outside of reserve areas.

Administrative authority: Forestry Department (Chief Conservator of Forests)

Designations:

Protected area Any area outside of a forest reserve may be protected to prevent the waste of trees or timber.

Farming may be allowed to continue so long as a licence is obtained from the Forest Reserve Commissioner.

Prohibited activities include: construction of buildings, damage to trees or timber, and setting fires to any vegetation without the written consent of the Commissioner.

Source: Original legislation

Title: Control of Bush Fires Law (PNDCL 46)

Date: 1983

Brief Description: Deals with the setting of fires in conservation or specified areas outside of gazetted reserves

Administrative authority: Forestry Department or Department of Game and Wildlife

Designations:

Conservation area Any government-protected natural resource area.

Within these areas fires may be set for the purpose of management provided that the fire is controlled and confined and authorisation has been granted by the Chief Conservator of Forests or the Chief Game and Wildlife Officer.

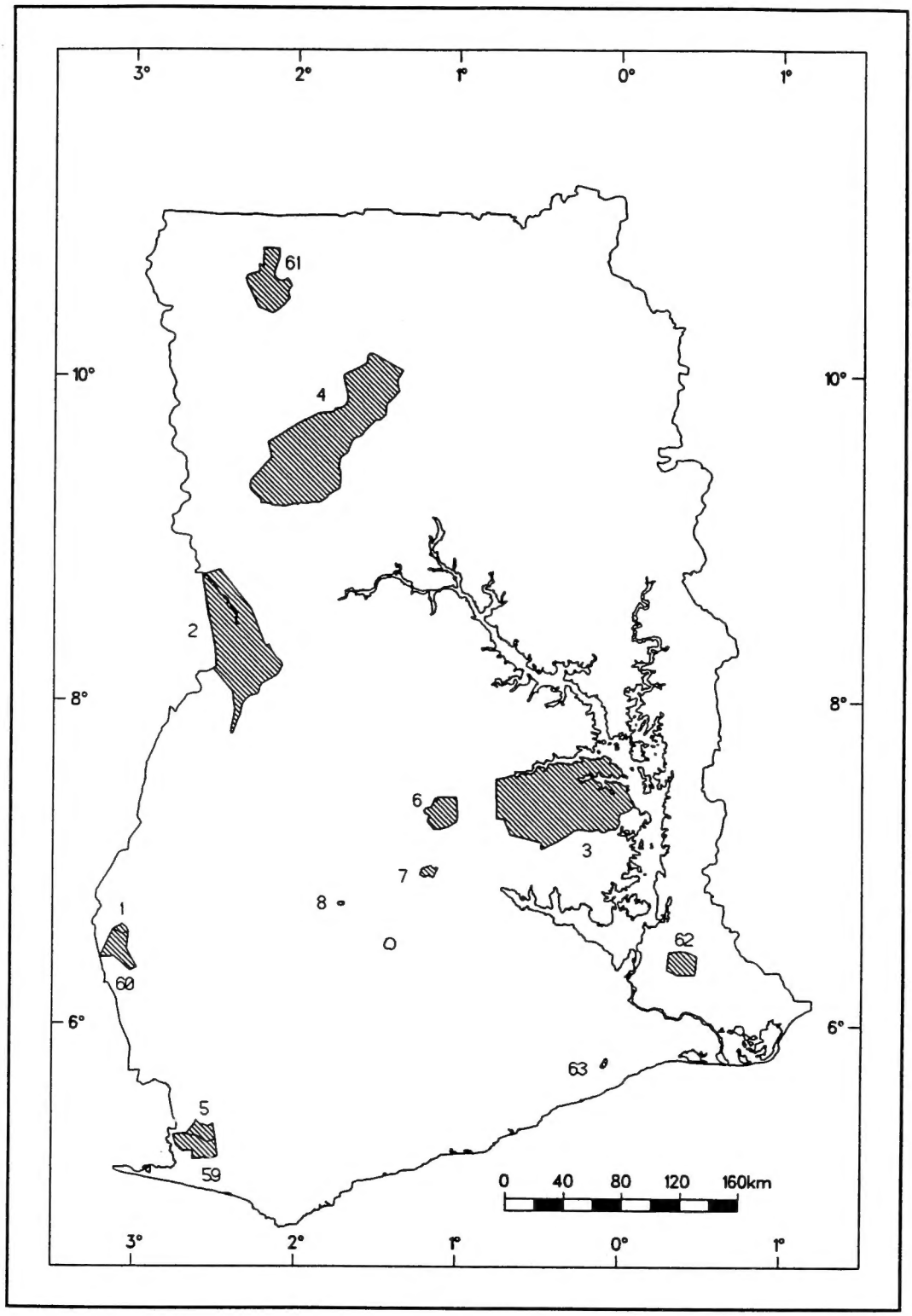
Specified area An area specified in permit by the Department of Game and Wildlife or the Forestry Department in which burning may be necessary for habitat management purposes.

Source: Original legislation

SUMMARY OF PROTECTED AREAS

Map ref.	*National/international designations* Name of area	IUCN management category	Area (ha)	Year notified
	National Parks			
1	Bia	II	7,770	1974
2	Bui	II	207,360	1971
3	Digya	II	312,595	1971
4	Mole	II	491,440	1971
5	Nini-Suhien	II	10,630	1976
	Strict Nature Reserve			
6	Kogyae	I	32,400	1976
	Wildlife Sanctuaries			
7	Bomfobiri	IV	5,184	1975
8	Owabi	IV	7,258	1971
	Game Production Reserves			
59	Ankasa	VIII	20,736	1976
60	Bia	VIII	22,810	1974
61	Gbele	VIII	54,691	1975
62	Kalakpa	VIII	32,400	1975
63	Shai Hills	VIII	5,443	1976
	Biosphere Reserve			
	Bia National Park	IX	7,770	1983
	Ramsar Wetland			
	Owabi	R	7,260	1988

Category VIII forest reserves are neither listed nor mapped.



Protected Areas of Ghana

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UNEP

WWF

The World Conservation Monitoring Centre is a joint-venture between the three partners who developed the *World Conservation Strategy* and its successor *Caring for the Earth*: IUCN-The World Conservation Union, UNEP- United Nations Environment Programme, and WWF-World Wide Fund for Nature.