

INTRODUCTION

In the development of an effective conservation programme for wetlands, one of the first steps is the compilation of an inventory of the most important wetland sites. Such wetland inventories already exist or are in progress for many parts of the world, e.g. the Western Palearctic, the Neotropical Realm, much of North America and the Afrotropical Realm. The 10th Meeting of the Asian Continental Section of the International Council for Bird Preservation (ICBP) in Sri Lanka in April 1984 examined the status of wetland conservation in Asia, and concluded that the identification of important sites was a priority task. Most southern and eastern Asian countries were represented at the meeting, and provided some basic information on their wetlands and waterfowl. This material, which was subsequently published by ICBP under the title "Wetlands in East Asia - A Preliminary Review and Inventory", provided an excellent basis for the development of a more comprehensive inventory.

At a series of meetings in 1985 between the International Union for Conservation of Nature and Natural Resources (IUCN), ICBP and the International Waterfowl and Wetlands Research Bureau (IWRB), it was agreed that a major effort should be undertaken to follow up the ICBP preliminary inventory with a detailed inventory of important wetlands throughout southern and eastern Asia. The World Wide Fund for Nature generously agreed to provide funding for the project. Initial discussions focused on the Indo-Malayan Realm. However, strict adherence to the boundaries of this biogeographical region would have meant that large parts of China and Indonesia, as well as the northern areas of Pakistan, India and Nepal, would have been outside the scope of the inventory. Since the compilation of an international inventory is best achieved through the promotion of national inventories, it seemed preferable to follow political rather than biogeographical boundaries. Once the decision was made to include the whole of China and Indonesia, it became logical to include the neighbouring countries of Mongolia, the Koreas, Japan and Papua New Guinea. Thus, it was agreed that the project the Asia Wetlands Inventory - should take in all countries from Pakistan and India to China, Japan, Indonesia and Papua New Guinea. The project was initiated in October 1985, and has culminated in the publication of the present volume.

The principal objective of the inventory has been to present as comprehensive a review as possible of existing knowledge of the important wetlands in the region under consideration. This has been achieved by pulling together information from the many available sources, such as governmental and non-governmental conservation bodies, fisheries institutions, hydrological institutions, universities and natural history museums. No special attempt has been made to carry out new field work at wetlands which remain poorly known; rather, one of the main aims of the inventory has been to identify areas in urgent need of study in the immediate follow-up period.

A Directory of Asian Wetlands follows a format similar to that of earlier Directories; thus the greater part of the Directory consists of a

series of national reports. Each begins with an introduction which summarizes the general situation of the wetlands, and provides information on the institutional and legal base for wetland conservation and research. Then follows a series of accounts of those wetlands which are known or thought to be of greatest importance from the point of view of nature conservation. The site descriptions include basic information on size and location, habitat types, principal vegetation, ownership, degree of protection, land use, fauna, threats, research, conservation and relevant literature.

The term "wetland" is here used in the sense defined in the text of the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the Ramsar Convention). Thus, wetlands are "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres". Coral reefs and other exclusively marine systems are, however, generally excluded from this definition, and have not been considered in this inventory.

In the discussion of fauna, special emphasis has been given to the waterfowl for several reasons. Waterfowl are conspicuous elements of the wetland fauna, readily identified, censused and studied; thus there tends to be much more information available on waterfowl than other wetlands species. Many are long-distance migrants, dependent on wetlands in a number of countries during the course of their annual cycle, and thus demonstrating the need for international cooperation in conservation efforts. Many species are popular game birds for the hunter, and as such constitute a renewable natural resource of considerable economic value. Finally, waterfowl are particularly good indicators of the general condition of wetland ecosystems; they are at or near the top of most wetland food chains, and are highly susceptible to wetland contamination and disturbance.

Each country report includes an outline map (or several maps) showing the location of the sites described in the inventory. For reasons of space, it has not been possible to include detailed maps of each site. However, the several hundred individual site maps which have been provided by contributors are on file at the World Conservation Monitoring Centre* in the United Kingdom, and constitute an important reference source. It is anticipated that many of these maps will be published in due course in the respective national wetland inventories.

The Directory concludes with a list of contributors. This list gives the names and addresses of the many individuals who have made significant contributions in the preparation of this work.

*The World Conservation Monitoring Centre (WCMC) was formerly known as the IUCN Conservation Monitoring Centre. In July 1988, the Centre was restructured as a joint venture between the three partners in the World Conservation Strategy, IUCN, UNEP (the United Nations Environment Programme) and WWF. WCMC may be referred to by its

former name in the text of this publication, most of which was prepared before July 1988.

Methodology

The compilation of the Directory has involved the collection of data through four main channels:

1. 'wetland working groups' or 'wetland committees' established to coordinate the preparation of national wetland inventories. In some cases, a researcher was employed for several months to compile the data;
2. national networks of contacts, each with a "national coordinator" responsible for the compilation of data in his or her country and preparation of a national report;
3. direct contact with individuals or institutions with expertise on particular sites or species;
4. a review of the recent literature.

In many cases, effective working groups and national networks were established and comprehensive national reports submitted. However, in several countries it proved impossible to coordinate the collection of information through a single person, group of individuals or institution, and material was received from several independent sources. In the case of Bhutan, Kampuchea and Mongolia, no local contact could be established, and the material presented in the Directory is based entirely on expatriate sources and the literature. Emphasis was given throughout to obtaining recent information from individuals currently working on wetlands and their fauna, and little attention was given to the older literature.

Site Descriptions

Contributors were requested to submit their information on wetlands on standard data sheets of a type used in similar wetland inventories in the Palearctic and Neotropical Realms. The information has been reproduced in this Directory in a slightly modified form, and in many cases with additional information from other sources. Each site description contains the following data categories:

Title: The name of the wetland with a reference number used in the accompanying map.

Location: The geographical coordinates (Greenwich), and general location of the site. With very few exceptions, the geographical coordinates have been taken from the Operational Navigation Charts (1:1,000,000) or Tactical Pilotage Charts (1:500,000) prepared by the Defense Mapping Agency Aerospace Center in Missouri, U.S.A.

Area: The area of the wetland habitat in hectares. In the case of some

rivers and coastal zones, only the approximate length of the site is known.

Altitude: The altitude of the wetland in metres above sea level.

Biogeographical Province: The biogeographical province in which the wetland is situated, following Udvardy (1975) "A Classification of the Biogeographical Provinces of the World" (IUCN Occasional Paper No. 18. IUCN, Gland).

Wetland type: A reference to the types of wetland habitat present, on the basis of the following numerical code:

- 01: shallow sea bays and straits (under six metres at low tide)
- 02: estuaries, deltas
- 03: small offshore islands, islets
- 04: rocky sea coasts, sea cliffs
- 05: sea beaches (sand, pebbles)
- 06: intertidal mudflats, sand flats
- 07: mangrove swamps, mangrove forest
- 08: coastal brackish and saline lagoons and marshes
- 09: salt pans (artificial)
- 10: shrimp ponds, fish ponds
- 11: rivers, streams - slow-flowing (lower perennial)
- 12: rivers, streams - fast-flowing (upper perennial)
- 13: oxbow lakes, riverine marshes
- 14: freshwater lakes and associated marshes (lacustrine)
- 15: freshwater ponds (under 8 hectares), marshes, swamps (palustrine)
- 16: salt lakes, saline marshes (inland drainage systems)
- 17: water storage reservoirs, dams
- 18: seasonally flooded grassland, savanna, palm savanna
- 19: rice paddies
- 20: flooded arable land, irrigated land
- 21: swamp forest, temporarily flooded forest
- 22: peat bogs

Although more sophisticated wetland classification systems are available, the information was seldom adequate to permit a more detailed breakdown, and in any case for many of the enormous wetlands described in the Directory, a detailed classification of habitat types would be extremely cumbersome.

Description of site: A general description of the site, including information on water regime, depth, salinity/acidity and permanence.

Climatic conditions: A brief note on the local climatic conditions.

Principal vegetation: A description of the principal aquatic vegetation, if known. In many cases, information was available only on the major terrestrial communities of the region.

Land tenure: Details of the ownership of the wetland and the ownership of surrounding areas.

Conservation measures taken: Details of any protected areas established at or around the wetland, and any other conservation measures taken at the site.

Conservation measures proposed: Details of any proposals for the conservation of the wetland.

Land use: Details of the principal forms of land use and human activities at the wetland and in surrounding areas.

Possible changes in land use: Any information available on proposed changes in land use and development plans which might affect the ecological character of the wetland.

Disturbances and threats: Details of existing and possible future threats to the wetland and its wildlife.

Economic and social values: Values of the wetland for fisheries production, water supply, flood control, storm protection, water purification, public recreation, conservation education, scientific research, etc.

Fauna: The importance of the wetland for wildlife including aquatic mammals, waterbirds, aquatic reptiles, amphibians, fishes and invertebrates. In some cases, noteworthy terrestrial species in surrounding areas are included, particularly when listed in the IUCN Red Data Books. In most cases, the scientific nomenclature follows the preferences of the major contributors. However, names of waterfowl have been standardized to conform with Morony, Bock and Farrand (1975), "Reference List of the Birds of the World" (American Museum of Natural History, New York).

Special floral values: Information on any plant species or communities for which the wetland is particularly important.

Research and facilities: A review of major research activities, completed and ongoing, and information on any existing facilities for research and education.

References: References to published literature and unpublished reports relevant to the site. The full citations are given in the bibliographies at the end of each national section.

Criteria for inclusion: A reference to the criterion or criteria which justify the inclusion of the site in the Directory. The criteria used in the selection process are those developed for the identification of wetlands of international importance for designation under Article 2 of the Ramsar Convention. These criteria, as adopted by the Conference of the Parties to

the Convention in Regina in June 1987, are as follows:

1. Criteria for assessing the value of representative or unique wetlands.

A wetland should be considered internationally important if it is a particularly good example of a specific type of wetland characteristic of its region. A wetland could be considered for selection under this criterion if:

1a: it is an example of a type rare or unusual in the appropriate biogeographical region;

1b: it is a particularly good representative example of a wetland characteristic of the appropriate region;

1c: it is a particularly good representative of a common type where the site also qualifies for consideration under criteria 2a, 2b or 2c;

1d: it is representative of a type by virtue of being part of a complex of high quality wetland habitats. A wetland of national value could be considered of international importance if it has a substantial hydrological, biological or ecological role in the functioning of an international river basin or coastal system;

1e: in developing countries, it is a wetland which, because of its outstanding hydrological, biological or ecological role, is of substantial socioeconomic and cultural value within the framework of sustainable use and habitat conservation.

2. General criteria for using plants or animals to identify wetlands of importance. A wetland should be considered internationally important if:

2a: it supports an appreciable assemblage of rare, vulnerable or endangered species or subspecies of plant or animal or an appreciable number of individuals of any one or more of these species;

2b: it is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna

2c: it is of special value as the habitat of plants or animals at a critical stage of their biological cycles;

2d: it is of special value for its endemic plant or animal species or communities.

3. Specific criteria for using waterfowl to identify wetlands of importance.

A wetland should be considered internationally important if..

3a: it regularly supports 20,000 waterfowl;

3b: it regularly supports substantial numbers of individuals from particular groups of waterfowl indicative of wetland values, productivity or diversity;

3c: where data on populations are available, it regularly supports 1% of the individuals in a population of one species or subspecies of waterfowl.

The above criteria are currently under review, and should not be regarded as exhaustive, especially in an Asian context.

A wetland is suitable for inclusion in the Ramsar Convention List of Wetlands of International Importance" and hence in this Directory if it meets any one of the criteria set out above. For convenience in the present inventory, the reference "123" has been applied to large and important wetlands which qualify for inclusion on the basis of criteria in all three categories.

For proper application of the Ramsar criteria, it is essential that a considerable body of information be available on the site in question. For many wetlands in Asia, the information is so scanty that no objective evaluation of the importance of the site can be made. If all such sites were to be ignored, the Directory would become little more than an inventory of wetlands which have been well studied and well documented, and would lose its value as a basis for the identification of priorities in future wetland surveys and research. In the selection of poorly known but potentially very important sites for inclusion in the inventory, it has been necessary to rely to a considerable extent on the subjective judgement of contributors. Sites selected on this basis, i.e. sites which are thought to be of considerable importance but which clearly merit further investigation, are given the reference "0".

Source: Names of individuals and institutions providing information on the site.

The headings "Climatic conditions", "Conservation measures taken", "Possible changes in land use", "Research and facilities" and "References" have been omitted when no relevant information was available to the compiler.

Comprehensiveness

For all countries in the region under consideration, it has been possible to provide at least a preliminary inventory of important wetlands on the basis of information received from contributors and the literature. However, in the case of Bhutan, Kampuchea and Mongolia, no local contacts were established, and the material presented herein is taken entirely from the

recent literature and the unpublished reports of visiting expatriates.

The comprehensiveness of the individual country reports varies greatly. In the case of the larger countries, notably China, India and Indonesia, the wetland inventories are still at a very preliminary stage. Most if not all of the larger wetlands and other sites of great international importance are now known and have been included in this Directory, but there doubtless remain many smaller wetlands which will in time be found to possess special qualities which justify their designation as wetlands of international importance. At the other extreme, in the case of several of the smaller countries the wetland inventories are thought to be very comprehensive; all sites of international importance have been included, along with a number of sites which are probably of only local or national importance. The inclusion of these latter sites is at least partly justified by the rapid rate at which wetlands are disappearing throughout the region as a whole and consequent rate at which the remaining undisturbed wetlands are increasing in importance.

One of the primary objectives of the Directory is to provide the stimulus and basis for the completion of detailed national wetland inventories which should include not only more information on the sites which meet international criteria, but also details of sites of only national or even local importance. In one or two Asian countries (e.g. India), work on such national inventories was initiated some years ago, while in several other countries, detailed national wetland inventories have been completed in conjunction with the Asian Wetlands Inventory. Only summaries of these national inventories have been incorporated here. The full reports have in some cases already been published in their country of origin (Indonesia and Japan), or will be in the near future (Malaysia, Pakistan, Papua New Guinea, Sri Lanka, Thailand and Vietnam). Most of the other contributions provide excellent skeletons upon which comprehensive national inventories can be based. Much more field work needs to be carried out, the larger wetland areas must be surveyed in detail so that key sites within them can be identified, and many new sites of national rather than international importance should be considered. Only when detailed national inventories are available for all the countries of the region will it be possible to compile the definitive directory of wetlands of international importance.

Acknowledgements

A Directory of Asian Wetlands is a compilation of information provided by many hundreds of individuals working on wetlands and their wildlife in Asia. The major contributors are listed in the Directory of Contributors at the end of this volume; to these the compiler is especially indebted. However, there are doubtless many others who have generously provided their information to regional and national coordinators for inclusion in this

work. The compiler would like to express his appreciation for their help,
and apologizes for being unable to thank them all by name.

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