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Classification and inventory of wetlands: A global overview

D.A. Scott & T.A. Jones
International Waterfowl and Wetlands Research Bureau, Slimbridge, Gloucestershire GL2 7BX, UK

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Abstract

Classification of wetlands is extremely problematical, definition of the term wetland being a difficult and controversial starting point. Although considerable effort has gone into the development of national and regional wetland classifications, the only attempt at establishing a global system has been under the auspices of the Ramsar Convention on Wetlands of International Importance. In view of the fact that the Ramsar Convention has 70 Contracting Parties world-wide, it is suggested that the Convention's definition and classification system should be adopted generally for international purposes. Much of the world has been covered by preliminary wetland inventories, but there is an urgent need to extend coverage to those areas not yet included. It is essential that all inventory projects give adequate attention to meeting the real information needs of agencies and individuals which have an impact on the conservation and wise use of wetlands. Attention should also be given to providing for wide dissemination and regular updating of information and establishment of procedures for monitoring ecological change at the sites identified.

Introduction

The classification and inventory of wetlands is fraught with difficulty. In fact, what is a wetland? Some parts of the world include land which may be completely dry for years, but which may nevertheless, support internationally important wetlands after period of exceptional rainfall. Where should the line be drawn between coastal wetlands and wholly marine systems? Should entirely man-made wetlands be given the same status as natural or semi-natural habitats? How should natural vegetational succession be covered? The delimitation of a wetland site is equally problematical; the impossibility of separating a wetland from its hydrological support system means that it is necessary to consider factors operating throughout a catchment, including sub-surface features, both upstream and downstream of the area under consideration.

Many published accounts of wetlands (especially national and local inventories; e.g. Environmental Problems Foundation of Turkey 1989) have largely avoided addressing such problems by classifying wetlands geographically and by using local terminology in descriptive text. Unfortunately, the attractive simplicity of this approach begins to break down when applied at an international scale. Although knowledge of the locations of the world's most important wetlands has taken great strides forward in the last fifteen years (e.g. Scott & Carbonell 1986; Whigham *et al.* 1993) there are still substantial areas of the globe which remain relatively uncharted. Even in areas which have been covered by preliminary wetland inventories, we lack, all too frequently, even a basic understanding of their hydrology, limnology and ecology.

Compilers of wetland inventories need to examine carefully whether they are gathering the data sets that are actually required for furthering the conservation and wise use of the sites which have been identified. The pressures which are leading to the degradation and destruction of many of the world's most important wetlands have an increasingly strong international dimension (Dugan 1993). It is, therefore, imperative that information concerning the locations and values of these sites is readily available to and understood by all those involved in formulating and implementing policies which affect them. Finally, wetland inventories

of all kinds must be regularly reviewed and updated if they are not to become items of historical interest only.

International wetland classification

Many countries have national or regional wetland terminology that is not understood internationally. For example, how many wetland scientists could confidently and correctly assign a geographical region and accurate meaning to all of the following wetland types, each of which is used commonly in one or more parts of the world:

vlei	rybník
lochan	valle
turfmoor	hammock
rhyne	turlough
qa	jheel

All of these terms have precise meanings which can rarely be translated into another language through use of a single word. Usually, a short phrase is required, employing internationally understood terms such as 'lagoon' or 'floodplain', together with qualifying statements covering, for example, seasonality, vegetation, salinity and human impacts.

An increasing number of countries have established some kind of national wetland classification, usually in association with the development of national wetland inventories (e.g. Silvius *et al.* 1987). By definition, these national classifications tend to focus on the unique characteristics of a country's wetlands and are therefore of limited use for international applications. The evolution of a national wetland classification is determined by many factors, but the geographical location of a country immediately determines that some wetland types common elsewhere in the world are likely to be excluded (to take an extreme example, there are no mangroves in Canada, but equally, there are no tundra wetlands in Indonesia). However, in spite of the large and increasing volume of international wetland research and conservation activities, there have been few attempts to produce international wetland classifications.

The purposes and values of international wetland classifications can be summarised as follows:

A. To provde readily understood terminology for use in scientific research and conservation projects with an international dimension.
B. To provide a framework for implementing international legal instruments for wetland conservation.
C. To assist international dissemination of information to as many relevant individuals and organisations as possible.

Whilst recognizing the technical and scientific benefits of establishing certain common standards and terms for describing wetlands, the rich cultural and linguistic heritage of wetland areas must not be overlooked. It would surely be a case of 'killing the goose that laid the golden egg' if, in our quest for harmonisation and synthesis we jeopardised the continuing existence of uniqueness and diversity, or risked alienating the local people responsible for day-to-day stewardship of the world's wetlands.

Before elaborating a wetland classification, it is necessary to adopt a definition of the term 'wetland'. Internationally, the most widely used and accepted definition is the one provided by the Convention on Wetlands of International Importance, usually referred to as the 'Ramsar' Convention after the Iranian town of Ramsar where the treaty was adopted in 1971 (Matthews 1993). Almost 80 countries, from all regions of the world, are now Contracting Parties to the Convention (see Table 1) and have therefore accepted the following definition for international purposes:

> '... wetlands are areas of marsh, fen, peatland or water, whether natural of 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.'

The rationale behind the very broad Ramsar definition stemmed from a desire to embrace all the 'wetland' habitats of migratory water birds; the full title of the treaty is, after all, *Convention on Wetlands of International Importance* ***especially as Waterfowl Habitat*** (Matthews 1993). Hence, the inclusion of areas of marine water less than six metres deep at low tide, which, at northern latitudes, are often important wintering habitats for loons (divers), grebes and sea ducks; and the inclusion of man-made wetlands such as reservoirs and seasonally flooded agricultural land, which are often important habitats for ducks, geese, cranes and shorebirds. Inevitably, however, a definition as broad as this has created problems. All areas of rice cultivation would

Table 1. Contracting parties to the Ramsar Convention – July 1993.

	Country	Date Convention came into force	Date Paris Protocol applied	Date Regina amendments accepted[1]	Number of wetlands designated	Area of wetlands (hectares)
1.	Australia	21.12.75	12.08.83	25.07.90	40	4,510,468
2.	Finland	21.12.75	15.05.84	27.03.90	11	101,343
3.	Norway	21.12.75	3.12.82	20.01.89	14	16,256
4.	Sweden	21.12.75	3.05.84	6.04.89	30	382,750
5.	South Africa	21.12.75	26.05.83	14.02.92	12	228,344
6.	Islamic Rep. Iran	21.12.75	29.04.86		18	1,357,550
7.	Greece	21.12.75	2.06.88	22.05.92	11	107,400
8.	Bulgaria	24.01.76	27.02.86	21.06.90	4	2,097
9.	UK	5.05.76	19.04.84	27.06.90	63	274,883
10.	Switzerland	16.05.76	30.05.84	9.06.89	8	7,049
11.	Germany	26.06.76	13.01.83	21.06.90	31	672,852
12.	Pakistan	23.11.76	13.08.85	20.09.88	9	20,990
13.	New Zealand	13.12.76	9.02.87	07.07.93	5	38,099
14.	Russian Federation	11.02.77	11.02.92	11.02.92	3	1,168,000
15.	Italy	14.04.77	27.07.87		46	56,950
16.	Jordan	10.05.77	15.03.84		1	7,372
17.	Yugoslavia	28.07.77			2	18,094
18.	Senegal	11.11.77	15.05.85		4	99,720
19.	Denmark	2.01.78	3.12.82		38	1,832,968
20.	Poland	22.03.78	8.02.84		5	7,141
21.	Iceland	2.04.78	11.06.86	18.06.93	2	57,500
22.	Hungary	11.08.79	28.08.86	20.09.90	13	114,862
23.	Netherlands	23.09.80	12.10.83	19.11.91	21	314,928
24.	Japan	17.10.80	26.06.87	2.06.88	9	83,454
25.	Morocco	20.10.80	3.10.85		4	10,580
26.	Tunisia	24.03.81	15.05.87	26.01.93	1	12,600
27.	Portugal	24.03.81	18.12.84		2	30,563
28.	Canada	15.05.81	2.06.83	8.11.88	31	13,020,203
29.	Chile	27.11.81	14.02.85		1	4,877
30.	India	1.02.82	9.03.84		6	192,973
31.	Spain	4.09.82	27.05.87		26	122,418
32.	Mauritania	22.02.83	31.05.89		1	1,173,000
33.	Austria	16.04.83	18.12.92	18.12.93	7	102,541
34.	Algeria	4.03.84			2	4,900
35.	Uruguay	22.09.84			1	435,000
36.	Ireland	15.03.85	15.11.84	28.08.90	21	13,035
37.	Suriname	22.11.85			1	12,000
38.	Belgium	4.07.86			6	7,945
39.	Mexico	4.11.86	4.07.86	2.11.92	1	47,840
40.	France	1.12.86	1.12.86		8	425,585
41.	USA	18.04.87	18.12.86		12	1,194,001
42.	Gabon	30.04.87	30.12.86		3	1,080,000
43.	Niger	30.08.87	30.04.87		1	220,000
44.	Mali	25.09.87	25.05.87		3	162,000
45.	Nepal	17.04.88	17.12.87		1	17,500
46.	Ghana	22.06.88	22.02.88		6	178,410

Table 1. Continued.

47.	Uganda	4.07.88	4.03.88		1	15,000
48.	Egypt	9.09.88	9.09.88		2	105,700
49.	Venezuela	23.11.88	23.11.88		1	9,968
50.	Viet Nam	20.01.89	20.09.88		1	12,000
51.	Malta	30.01.89	30.09.88		1	11
52.	Guinea-Bissau	14.05.90	14.05.90		1	39,098
53.	Kenya	5.10.90	5.06.90		1	18,800
54.	Chad	13.10.90	13.06.90		1	195,000
55.	Sri Lanka	15.10.90	15.06.90		1	6,216
56.	Guatemala	26.10.90	26.06.90		1	48,372
57.	Bolivia	27.10.90	27.06.90		1	5.240
58.	Burkina Faso	27.10.90	27.06.90		3	299,200
59.	Panama	26.11.90	26.11.90		2	97,179
60.	Ecuador	7.01.91	7.09.90		2	90,137
61.	Croatia	25.06.91			4	80,455
62.	Slovenia	25.06.91			1	650
63.	Romania	21.09.91	21.05.91		1	647,000
64.	Liechtenstein	6.12.91	6.08.91	6.08.91	1	101
65.	Zambia	28.12.91	28.08.91		2	333,000
66.	Peru	30.03.92	30.03.92		3	2,415,691
67.	Costa Rica	27.04.92	27.12.91		3	30,269
68.	China	31.07.92	31.03.92		6	586,870
69.	Indonesia	8.08.92	8.04.92	8.04.92	1	162,700
70.	Argentina	4.09.92	4.05.92		3	82,474
71.	Bangladesh	21.09.92	21.05.92	21.05.92	1	59,600
72.	Czech Republic	1.01.93	1.01.93		4	18,109
73.	Slovak Republic	1.01.93	1.01.93		7	25,519
74.	Guinea	18.03.93	18.11.92		6	264,109
75.	Trinidad & Tobago	21.04.93	21.12.92	21.12.92	1	6,234
76.	Papua New Guinea	16.07.93	16.03.93		1	590,000
77.	Brazil	24.09.93	24.05.93		2	168,400
78.	Armenia	9.10.93	9.06.93		2	51,976
79.	Honduras	23.10.93	23.06.93		1	8,500
	former USSR				9	1,819,185
					623	38,202,706

[1] For an explanation of the Paris Protocol and Regina Amendments, see Matthews 1993.
Information supplied by the Ramsar Database.

technically qualify as wetlands, though most such areas are of scarcely any conservation value. Similarly, a large part of the world's coral reefs and sea-grass beds qualify as wetlands. If coral reefs are to be included, perhaps the definition should embrace all such systems, rather than only those above the six metres limit.

At a national level, many countries have adopted narrower definitions; for example, some countries do not consider large rivers or water storage reservoirs as wetlands. However, the Ramsar definition is increasingly providing the basis for both national and international inventories, as more and more countries ratify the Convention and, in doing so, accept the definition for at least international purposes.

One of the first international wetland classifications was employed by Scott (1980) in *A Preliminary Inventory of Wetlands of International Importance for Waterfowl in West Europe and Northwest Africa.* Correspondents in each country were asked to complete a simple datasheet for each site, indicating which of 25 habitat types was present within the site. The classification was based on work being undertaken in Paris on behalf of the European Community in relation to the then fledgling Community-wide Directive on the Con-

Table 2a. Classification of wetland type used in the Directory of Neotropical Wetlands (Scott & Carbonell 1986).

01	shallow sea bays and straits
02	estuaries, deltas
03	small offshore islands, islets
04	rocky sea coasts, sea cliffs
05	sea beaches (sand, pebbles)
06	intertidal mudflats, sandflats
07	coastal brackish and saline lagoons & marshes, salt pans
08	mangrove swamps, brackish forest
09	slow-flowing rivers, streams (lower perennial)
10	fast-flowing rivers, streams (upper perennial)
11	riverine lakes (including oxbows), riverine marshes
12	freshwater lakes and associated marshes (lacustrine)
13	freshwater ponds (< 8 ha), marshes, swamps (palustrine)
14	salt lakes, salars (inland systems)
15	reservoirs, dams
16	seasonally flooded grassland, savanna, palm savanna
17	rice paddies, flooded arable land, irrigated land
18	swamp forest, temporarily flooded forest
19	peat bogs, wet Andean meadows (bofedales), snow melt bogs

Table 2b. Classification of wetland type used in the Directory of Asian Wetlands (Scott 1989a).

01	shallow sea bays and straits (< 6 m depth 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, sandflats
07	mangrove swamps, brackish forest
08	coastal brackish and saline lagoons and marshes
09	salt pans
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 (< 8 ha), 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

Source: Ramsar Convention Bureau (1990).

servation of Wild Birds. In addition to wetlands *per se*, this classification included certain dryland habitats which are commonly found in association with Western Palearctic wetlands.

A number of subsequent international wetland inventories have followed the simple type of classification described above. For example, the Directories of Neotropical Wetlands (Scott & Carbonell 1986) and Asian Wetlands (Scott 1989a) employed broadly similar systems, which are reproduced below in Table 2. The introductions to both of these Directories include the note that, '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'.

Recognizing the limitations, in terms of both quantity and quality, of data available for many countries is fundamental to the construction of an international wetland classification. In the development of hierarchical classifications, there is always a temptation to focus debate on the most detailed (and hence, usually the most controversial) level rather than on broader generic categories. This can result in a classification which is partly (or even mostly) irrelevant to the level of information available from much of the world.

During the late 1980s, the Contracting Parties to the Ramsar Convention recognised the need for establishing a database to hold information on those wetlands designated under Article 2.1 of the treaty for the Ramsar *List of Wetlands of International Importance*. In connection with setting up a database, the Contracting Parties also charged the Ramsar Bureau with establishing a wetland information sheet and classification of wetland type aimed at standardising the data gathered for each Ramsar site.

In 1990, as a result of this initiative, the Fourth Meeting of the Conference of the Contracting Parties adopted a Recommendation approving an information sheet and hierarchical classification of wetland type (Scott 1989b) based loosely on the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin *et al.* 1979). The US classification is divided into systems, sub-systems, classes and sub-classes, together with a series of modifiers concerning water regime, water chemistry (salinity, pH) and soil. The

basic unit of the hierarchy is the system, of which five types are distinguished (marine, estuarine, riverine, lacustrine and palustrine). Both the US classification and the version adopted for use with the Ramsar Convention are reproduced here as Tables 3 and 4, respectively.

A number of authors have suggested the use of highly simplified groupings of basic wetland types for use in general information and education materials. For example, Dugan (1990) has suggested that it is possible to reduce the more detailed groupings of the Ramsar classification to, 'seven landscape units which are wetlands, or where wetlands form an important component, and which therefore define the planning framework for wetland conservation'. These units are estuaries, open coasts, floodplains, freshwater marshes, lakes, peatlands and swamp forest.

The Ramsar database, which is maintained at Slimbridge, UK by IWRB, has been in operation for approximately 4 years, during which time habitat information received from Contracting Parties concerning their designated Ramsar sites has been coded and entered into a dBaseIV system. The habitat information is stored in conjunction with a wide range of other site data, from geographical coordinates to landuse. When updated material has been provided by all Contracting Parties, use of the Ramsar classification will make it possible to analyse the Convention's coverage of the principal wetland types, thereby allowing the identification of gaps for immediate attention. The Ramsar classification is, like all classifications, a compromise. However, experience to date suggests that the Ramsar system is workable and readily understood and we suggest that it should be used as the basis for appropriate international projects in the future.

One on-going mathematical classification and inventory project has recently been completed; the *Directory of Important Wetlands in Australia* (Usback & James 1993) was published in June 1993. It was compiled using the Ramsar classification system with minor modifications to provide specifically for wetland types which it is important to distinguish in a national context. A number of other national or regional classifications of wetland type have been elaborated; countries covered by recent publications include Canada (National Wetlands Working Group 1987), Greece (Heliotis 1988), Indonesia (Silvius et at. 1987) and South Africa (Walmsley & Boomker 1988). Accounts of several such projects will be presented later in this volume but it is worth looking at some of the contrasting classifications that have been adopted. For example, the Canadian classification includes five wetland classes and 70 wetland forms, of which 18 are types of bog and 17 are types of fen; while the Indonesian classification has broken down forested wetlands into six types of mangrove forest and eight types of freshwater swamp forest.

In July 1992, the European Community published the official version of a Community-wide Directive obliging the twelve Member States to undertake measures which will conserve certain scarce or threatened habitats and species, as specified in Annexes to the so-called *Habitats Directive* (Official Journal of the European Communities 1992). Annex 1 to the Directive lists 'Natural habitat types of Community interest whose conservation requires the designation of Special Areas of Conservation'. The classification of habitats used is that developed during the 1980s under the Community's *CORINE* biotopes project. The CORINE classification is hierarchical with a strong phytosociological element and is extremely detailed. Thus, Annex 1 of the Habitats Directive (which, as indicated above, includes only those habitats thought to be in need of special conservation measures) includes at least 50 specific wetland habitat types which fall within the Ramsar definition. Although it is an international classification, it is strictly concerned with the territory of the European Community and is much too elaborate for effective world-wide application.

International wetland inventories

In the course of developing an effective wetland conservation programme, one of the first steps is the compilation of a basic inventory of wetlands (covering at least the more important and/or vulnerable sites) in the relevant geographical area. One expression of the burgeoning interest in wetlands in recent years has been the proliferation of inventory projects. Such inventories may:

- aid identification of priorities for future action in research, protection and management;
- establish the basis for monitoring the conservation status of wetlands;
- facilitate local, national and international comparisons between sites;
- promote increased awareness of/interest in key wetland sites on the part of politicians, government officials, land use planners, students and scientists.

Table 3. Hierarchy of wetlands and deepwater habitats in the U.S. wetland classification (Cowardin *et al.*, 1979), showing systems, subsystems and classes. The Palustrine system does not include deepwater habitats.

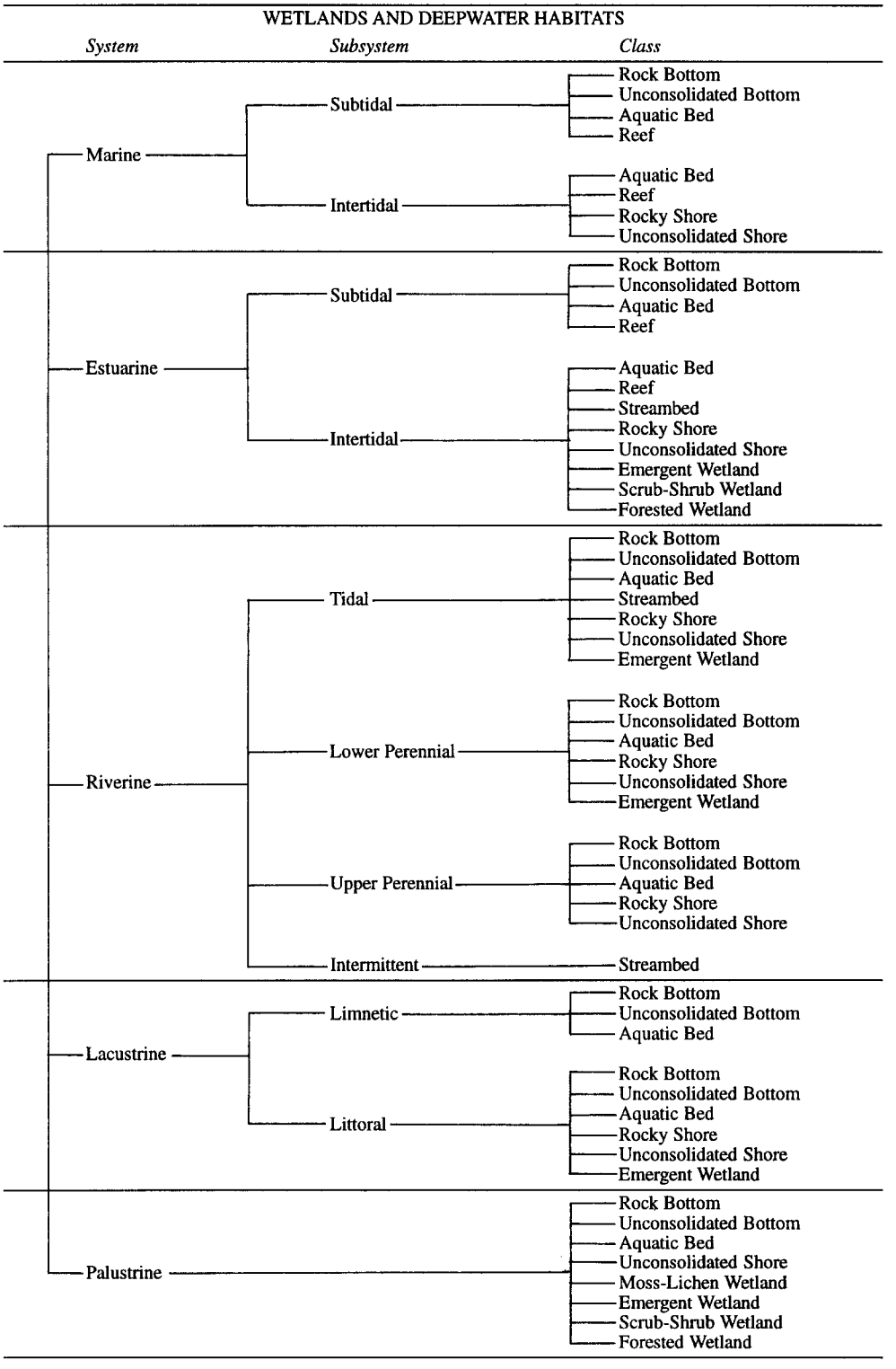
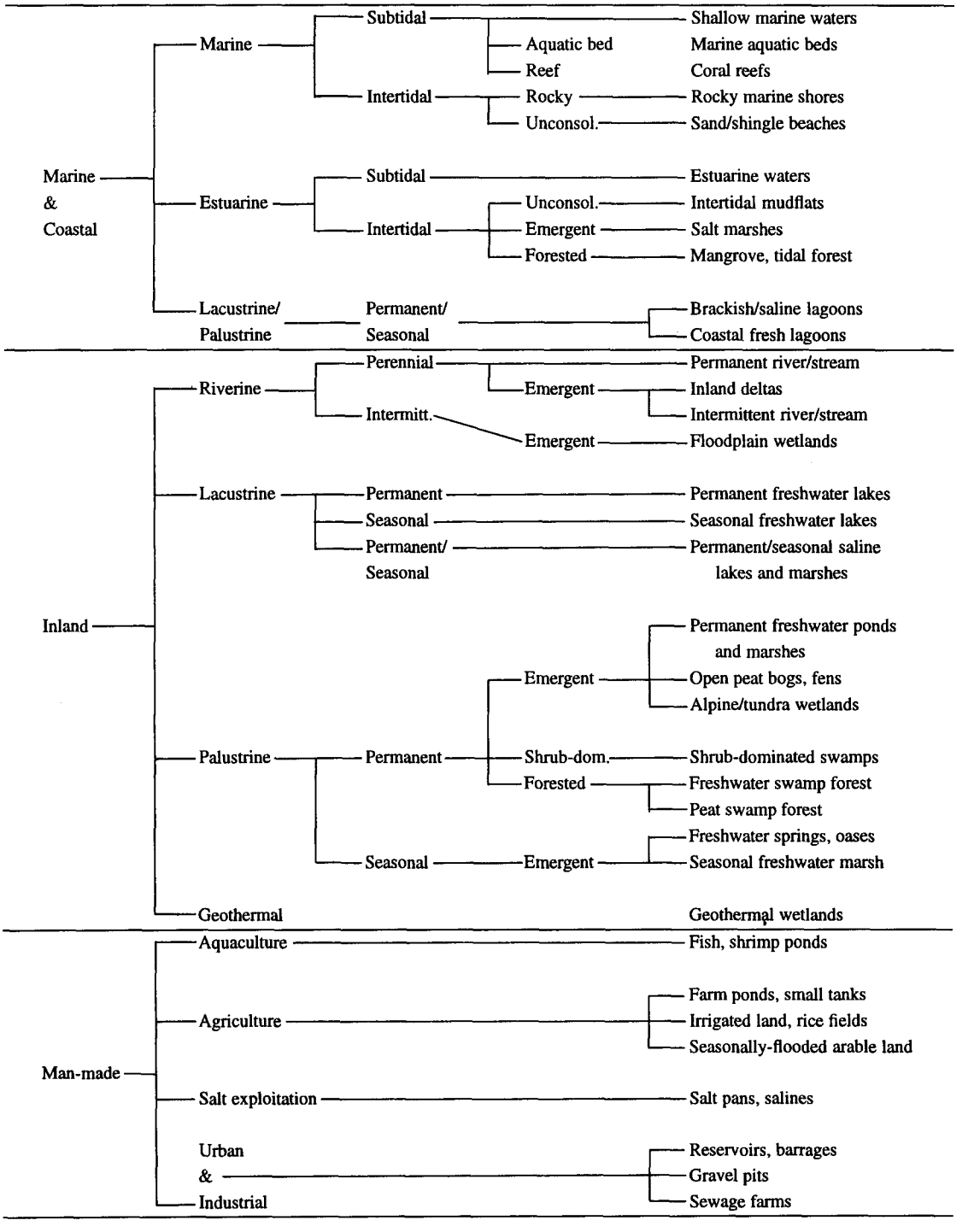


Table 4. Wetland classification used by the Ramsar Convention Bureau.



National wetland inventories date back at least as far as the early 1950s and a number of countries, particularly in Europe and North America, have now produced some kind of inventory of their wetland resources. These vary greatly in scope and depth of treatment, from simple lists of major water bodies, to comprehensive descriptions of all wetland resources in the country concerned.

Nowhere has this inventory work been taken to greater technical lengths than in the United States. A major project was initiated by the US Fish & Wildlife Service in 1974 'to provide needed data and information so that decision-makers can make informed decisions about wetland resources, knowing how many, of what type, are where, as well as what they functionally contribute'. Scientists responsible for implementing the inventory experimented with various types of remote sensing, and finally decided to utilize high altitude stereoscopic aerial photography. At that time, satellite imagery could not consistently identify and classify wetlands to the degree of accuracy required. However, it seems likely that the more recent generations of satellites with enhanced capabilities will be able to do this, and will certainly be useful in monitoring changes in wetland resources.

Comprehensive inventories of this type are extremely expensive and time consuming. The U.S. Wetlands Inventory has already cost tens of millions of dollars over the last 18 years and will require further massive investment prior to completion. It is clearly impossible for all but the richest countries to carry out inventories of this kind; indeed, the time scale for such detailed work could mean that internationally important wetlands become degraded or destroyed during the course of inventory compilation. If we are to conserve and make wise use of the most important wetlands in global terms, it is necessary to consider the results which have been obtained from simpler methodologies.

During the late 1950s, the International Society of Limnologists (SIL) decided to prepare a worldwide list of lakes and rivers whose protection was considered to be particularly desirable. The International Biological Programme eventually took over the project, aptly named Aqua, and published its list of sites in 1971 (Luther & Rzoska 1971). Meanwhile, IUCN had embarked on the compilation of a list of marshes, bogs and other wetlands of international importance, primarily as waterfowl habitat, in Europe and North Africa. This list, known as the MAR List (Olney 1965), was deliberately restricted to about 200 sites, since it was felt that governments and conservation bodies at that time would not be able to cope with many more sites.

With the rapid advances in knowledge of wetlands in the 1960s and early 1970s, the Aqua and MAR lists rapidly became out of date. Table 5 makes a comparison between the number of wetlands in each country included in the MAR list, and those which, almost 30 years on, have been designated under the Ramsar Convention. It is clear that substantial progress has been made in Western Europe, but the situation in Eastern Europe and North Africa gives cause for some concern.

With the Ramsar Convention coming into force in 1975, there arose a need for widely accepted criteria for the identification of sites of international importance. Provisional criteria were approved at a Wetlands Conference at Heiligenhafen, Germany, in 1974, and later refined at the Conference of the Contracting Parties to the Convention (most recently at Montreux, Switzerland, in 1990; see Table 6). These criteria pertain to: (a) the representative character or uniqueness of the sites; (b) the value of the sites for threatened or endemic species of animals and plants and for maintenance of biodiversity; and (c) the importance of the sites for populations of waterfowl.

Under the terms of the Ramsar Convention, Contracting Parties are required to designate sites for inclusion in the Convention List of Wetlands of International Importance. Once criteria for site selection had been developed, it became possible to compile basic lists, or 'shadow lists', of all those sites which might be eligible for designation as Ramsar sites. The first of these such lists was compiled for IUCN and the United Nations Environment Programme (UNEP), and covered the Western Palearctic Region. This *Directory of Western Palearctic Wetlands* (Carp 1980) was based on both the MAR and Aqua lists, and combined sites of ornithological interest with sites of limnological and botanical interest. It covers forty-four countries in Europe, North Africa and the Middle East, and lists almost 900 sites.

At about the same time, the International Waterfowl and Wetlands Research Bureau (IWRB) was pulling together the extensive information derived from wetland surveys and waterfowl counts in western Europe and north-west Africa. Detailed counts of wildfowl, shorebirds, and in many cases also pelicans, herons and other water birds, were available for most wetlands in western Europe, as were some estimates of the total size of the populations, making it possible to

Table 5. Comparison of wetland sites listed by the MAR project and those subsequently designated under the Ramsar Convention.

Country	No. of sites on MAR list published 1965	No. of Ramsar sites designated by July 1993
Albania	0	Not a Ramsar Party
Algeria	5	2
Andorra	0	Not a Ramsar Party
Armenia	0	2
Austria	3	7
Azerbaijan	1	Not a Ramsar Party
Belarus	0	Not a Ramsar Party
Belgium	2	6
Bulgaria	4	4
Croatia	1	4
Czech Republic	3	4
Denmark	4	3
Estonia	2	Not a Ramsar Party
Finland	3	11
France	21	8
Georgia	0	Not a Ramsar Party
Germany	16	31
Greece	7	11
Hungary	6	13
Iceland	0	2
Italy	7	46
Latvia	1	Not a Ramsar Party
Liechtenstein	0	1
Lithuania	1	Not a Ramsar Party
Luxembourg	0	Not a Ramsar Party
Malta	0	1
Moldova	0	Not a Ramsar Party
Monaco	0	Not a Ramsar Party
Morocco	7	4
Netherlands	10	21
Norway	7	14
Poland	15	5
Portugal	4	2
Romania	5	1
Russia	4	3
Slovak Republic	2	7
Slovenia	9	1
Spain	10	26
Sweden	17	30
Switzerland	7	8
Tunisia	8	1
Turkey	8	Not a Ramsar Party
Ukraine	0	Not a Ramsar Party
United Kingdom	20	62
Yugoslavia	4	2

Table 6. Ramsar criteria for listing wetlands of international significance.

A wetland qualifies for designation as a Ramsar site if:

1. The site is:

   (a) a particularly good representative example of a natural or near-natural wetland, characteristic of the appropriate biogeographical region; or

   (b) a particularly good representative example of a natural or near-natural wetland, common to more than one biogeographical region; or

   (c) a particularly good representative example of a wetland, which plays a substantial hydrological, biological or ecological role in the natural functioning of a major river basin or coastal system, especially where it is located in a trans-border position; or

   (d) an example of a specific type of wetland, rare or unusual in the appropriate biogeographical region.

and/or

2. The site:

   (a) 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; or

   (b) 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; or

   (c) is of special value as the habitat of plants or animals at a critical stage of their biological cycles.

and/or

3. The site:

   (a) is of special value for one or more endemic plant or animal species or communities; or

   (b) regularly supports 20,000 waterfowl; or

   (c) regularly supports substantial numbers of individuals from particular groups of waterfowl, indicative of wetland values, productivity or diversity; or

   (d) where data are available, regularly supports 1% of the individuals in a population of one species or subspecies of waterfowl.

apply objectively the Ramsar criteria concerning water birds and thereby determine which wetlands qualified for inclusion on the Ramsar List on the basis of numbers of birds present. IWRB published this assessment in *A Preliminary Inventory of Wetlands in West Europe*

and Northwest Africa (Scott 1980), which describes over 500 wetlands in 22 countries. This work has subsequently been updated and expanded by a joint ICBP/IWRB project, the final report of which is entitled *Important Bird Areas in Europe* (Grimmett & Jones 1989) and contains brief accounts of around 1200 wetland sites important for birds. The project covered all of Europe, including Greenland, Russia as far east as the Ural mountans, and the whole of Turkey.

Wetland inventory and monitoring in the Mediterranean region will be extended in the next few years with the implementation of the MEDWET initiative; a major wetland conservation project being funded by the European Community. IWRB has been given the responsibility to test a wetland inventory methodology which can be employed throughout the Mediterranean Basin. MEDWET involves close cooperation between Governments and NGOs, with the Bureau of the Ramsar Convention playing an important coordinating role.

Since the development of initial inventories of European wetlands in the late '70s and early '80s, most of the globe has been covered by some kind of wetland inventory. In Africa, the lead was taken by limnologists who began in the 1970s to compile information on wetlands of limnological interest for publication in handbook form. This work was subsequently taken over by UNEP and IUCN, and expanded into a full-scale directory of major wetlands in the Afrotropical Realm, covering about thirty-five countries in Africa south of the Sahara (Hughes & Hughes 1992), although it would be misleading to suggest that this work forms a comprehensive inventory of internationally important wetlands. Another important publication on the wetlands and shallow water bodies of Africa sponsored by ORSTOM (Burgis & Symoens 1987) provides detailed information on many of Africa's largest and best-known wetlands, but has many gaps in coverage, and is therefore also of limited value; much work remains to be done.

In the Neotropical Region, the lead was taken by IWRB. At a meeting in Edmonton, Canada, in 1982, IWRB launched an ambitious Neotropical Wetlands Project which, amongst other things, included the compilation of an inventory of wetlands of international importance in South and Central America and the Caribbean. The project was jointly sponsored by ICBP and IUCN and was funded by a variety of organizations, notably WWF-US, the US Fish and Wildlife Service and the Canadian Wildlife Service. The resulting *Directory of Neotropical Wetlands* summarises information received from over 280 contributors, and describes 730 wetlands covering 118 million hectares in forty-five countires (Scott & Carbonell 1986).

The lead was taken in South and East Asia by the International Council for Bird Preservation (ICBP) at its 10th Asian Continental Section Meeting in Sri Lanka in 1984. This meeting focused on the wetlands and waterfowl of southern and eastern Asia and concluded that the identification of important sites in the region was a priority task. The reports presented at the meeting were published in the form of a preliminary inventory which listed 488 wetlands of importance for waterfowl in 21 countries (Karpowicz 1985). In late 1985, IWRB and IUCN joined ICBP in a three-year project – the Asian Wetlands Inventory – to compile a comprehensive inventory of wetlands of international importance in southern and eastern Asia. This inventory, funded by WWF, was similar in general approach to the Neotropical Inventory, but much broader in scope in that it gave consideration to all the natural functions and values of wetlands, and was therefore less specifically oriented towards the values of wetlands for wildlife.

The Asian Wetlands Inventory covered all twenty-four countries from Pakistan to China, Japan, Indonesia and Papua New Guinea. Over 500 individuals and organisations participated in the project, and in most countries, national coordinators were appointed and wetland working groups or committees set up. The final report of the project, entitled *A Directory of Asian Wetlands* describes a total of 947 wetlands covering over 73 million hectares (Scott 1989). The Directory was published by the World Conservation Monitoring Centre, and has been distributed free of charge to all major participants.

The *Directory of Neotropical Wetlands* and the *Directory of Asian Wetlands* vividly demonstrate the value of international wetland inventories in establishing priorities. They constitute overviews of the wetland situation throughout large regions of the globe, and provide valuable information on the total area of wetlands of international importance, the number of wetlands enjoying some legal protection, and the total area under protection. They provide us with an excellent basis for planning future research, enabling us to identify areas in urgent need of basic surveying work or more detailed study. They also provide a considerable amount of information on the principal threats to wetlands; in fact, some threat was reported at over 80% of the sites in both regions, and no less than 50% of the sites were considered to be under moderate to serious threat (Scott & Carbonell 1985; Scott & Poole

1989). The directories reveal the great regional variations that exist both in the extent of protection and in the degree of threat, and can thus be used to identify those wetland ecosystems which are least well represented in networks of protected areas and which are in most urgent need of attention.

Two other wetland inventories of this type have very recently been completed and published; one covering Oceania and the other covering Australia. *A Directory of Wetlands in Oceania* (Scott 1993), funded jointly by IWRB, the Asian Wetland Bureau (AWB), the South Pacific Regional Environment Program (SPREP) and the Ramsar Bureau, was initiated in September 1989. The report describes the principal wetland ecosystems in 24 island nations and territories in the Pacific. A companion volume dealing with the internationally important wetlands of New Zealand, is being prepared by the New Zealand Department of Conservation. *A Directory of Important Wetlands in Australia* was compiled under the auspices of the Australian Nature Conservation Agency (formerly Australian National Parks and Wildlife Service).

Excluding Antarctica, which has few wetlands in the conventional sense, the only other major regions of the globe which have not as yet been covered by national or international wetland inventories are the Asian part of Russia, together with other Central Asian Republics of the CIS; and the Middle East. IWRB is currently coordinating the project development phase of an inventory of the Baltic Republics, CIS and Georgia. Parts of the Middle East were incorporated in the UNEP/IUCN Directory of Western Palearctic Wetlands (Carp 1980), but very little information was given for most of the listed sites, and the Arabian Peninsula was excluded. A project to remedy this situation is currently being elaborated (Scott 1992).*

With increasing coverage of regional wetland inventories came attempts to compile global accounts of particular ecosystems. For example, the Working Group on Mangrove Ecosystems of IUCN's Commission on Ecology has produced a report on the global status of mangroves (Saenger *et al.* 1983), while the Scientific Committee on Oceanic Research (SCOR) is conducting a 'Biosphere Inventory Report' of mangroves around the world. UNEP and IUCN have also sponsored the compilation of a world inventory of coral reefs, many of which fall under the definition of wetlands contained in the Ramsar Convention (UNEP/IUCN 1988). On a much broader scale, the International Society of Ecologists (INTECOL) has been working for some years on the preparation of a major publication on the world's wetlands (Whigham *et al.* 1993); IWRB has recently produced a general account of the world's principal wetlands (Finlayson & Moser 1991), and IUCN has taken the lead in developing a global wetlands atlas (Dugan 1993). In another recent initiative, the UK Department of the Environment commissioned the first phase of a study of wetlands in the UK Dependent Territories aimed at reviewing the potential for Ramsar site designations (Hepburn *et al.* 1992).

Obviously, wetland inventories of this type, useful though they may be, are only 'snap shots' of the situation at the time of their compilation. Within a very few years, they become so out of date as to become almost useless for conservation planning. It is essential that the information, once collected and centralized, be updated as new information becomes available. Unfortunately, a proposal by the World Conservation Monitoring Centre to establish just such a global wetland database to serve as a central clearing house for information has so far failed to attract the necessary funding. As a consequence, the information gathered during the various regional inventories remains scattered between a variety of international and regional conservation bodies, and almost no coordinated updating of information has been possible, except with respect to wetlands designated for the Ramsar List.

Information on Ramsar sites is currently maintained in a database by IWRB on behalf of the Ramsar Convention Bureau. In the past, the World Conservation Monitoring Centre has updated site data at regular intervals for publication in conjunction with each Conference of the Contracting Parties. The most recent edition of the *Directory of Wetlands of International Importance*, prepared by WCMC for the Fourth Conference of the Contracting Parties in Montreux, Switzerland, in 1990, contains information on all 465 sites listed by the 52 countries which were parties to the convention at that time (Ramsar Convention Bureau 1990). As of July 1993, there were 623 Ramsar sites; completely revised texts on each (approved by the Contracting Parties concerned) were published in June 1993 at the Fifth Meeting of the Conference of the Contracting Parties (Jones 1993).

There also needs to be careful consideration of the data sets gathered; for example, few of the existing international publications contain easily analysed information on wetland functions, nor has there been any systematic collection of quantifiable data for use in monitoring ecological change in wetlands. The latter point provided the focus for debate in one of the

workshops at IWRB's Board Meeting in Florida (St. Petersburg Beach, 16–17 November 1992), the results of which were also conveyed to the Contracting Parties to the Ramsar Convention at their triennial meeting in Kushiro, Japan, in June 1993.

By the time that the entire world has been covered by preliminary inventories, it seems likely that we will have identified over 5,000 wetlands as being of 'international importance' for nature conservation. If we are able to take full advantage of these inventories and the wealth of information which they have generated, it is essential that the information be centralized and standardized for easy access and updating. Otherwise there is a real danger that much of the original information will be lost or become so out of date as to be almost useless, in which case we will find ourselves having to repeat the inventories all over again, almost from scratch.

Conclusion

Definition of wetland. A globally accepted definition is desirable. The Ramsar definition has been accepted in principle by 79 Contracting Parties and has been used in many international inventory projects. It will also be used in compilation of the forthcoming inventory of Middle Eastern wetlands. The Ramsar definition cannot be changed except by a complex and time-consuming legal procedure to amend the Convention text. We therefore recommend use of the Ramsar definition for international purposes, although the Ramsar Bureau could be encouraged to develop guidelines for interpretation of the definition – especially in relation to man-made wetlands and marine ecosystems.

Global classification of wetlands. There is a need for a simple global classification system, and in spite of its inevitable shortcomings, much progress has already been made with the Ramsar classification. We believe that there is little to be gained in terms of wetland conservation by working on the development of an entirely new system and therefore advocate the utilisaton of the Ramsar system for use in all international fora.

Regional, national and local classifications. These can and should be as detailed as is necessary or feasible. However, for ease of international exchange and transfer of information on key sites, it is preferable if the broader categories in such classifications are compatible with the Ramsar hierarchy.

Global coverage of wetland inventories. There is an urgent need to complete global coverage of preliminary wetland inventories. International wetland organisations should aim to produce before the year 2000, an inventory of all the world's wetlands which qualify for designation under the Ramsar Convention. This inventory should be compiled on the basis of maximising technical objectivity and should not be controlled solely by political considerations. Governments are as free as they have always been to produce their own inventories.

Coverage of national wetland inventories. All countries that have not already done so, should be encouraged to produce their own, detailed national wetland inventories. These should cover wetlands of national or local importance as well as the sites already identified by international projects.

Follow-up to inventory projects. All wetland inventories should provide scope for:

- regular updating
- functional analysis
- monitoring ecological change and wetland loss
- provision of information most useful to wetland conservation
- wide dissemination of inventory results.

Location and accessibility of wetland inventory data. There is an urgent need for original data gathered under international inventory projects to be centralised at a location that will:

- provide for networking with other databases
- permit ready access to data
- facilitate updating of information
- publicise/promote the existence of such data sets.

* The Middle East Wetland Inventory Project is now (1995) nearing completion.

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