Review of wetland inventory information in Africa

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A large and helpful network of old and new contacts provided us with references, contacts and tips. Please see the list of persons and institutions contacted which are listed in Annex 1. Finally, we'd like to thank Mike Smart who, while at the Ramsar Bureau, was always asking the question 'Just how much wetland is there in the world?'

1 Introduction

The African countries covered by this review are listed below in table 1.1. These countries constitute the Ramsar Region of Africa that encompasses some fifty-five countries. This includes all the countries in continental Africa, bordered by the Red Sea in the north east of Africa, and includes Madagascar, the Seychelles, the Cape Verde Islands, Mauritius, Sao Tome and Principe and Comoros Islands.

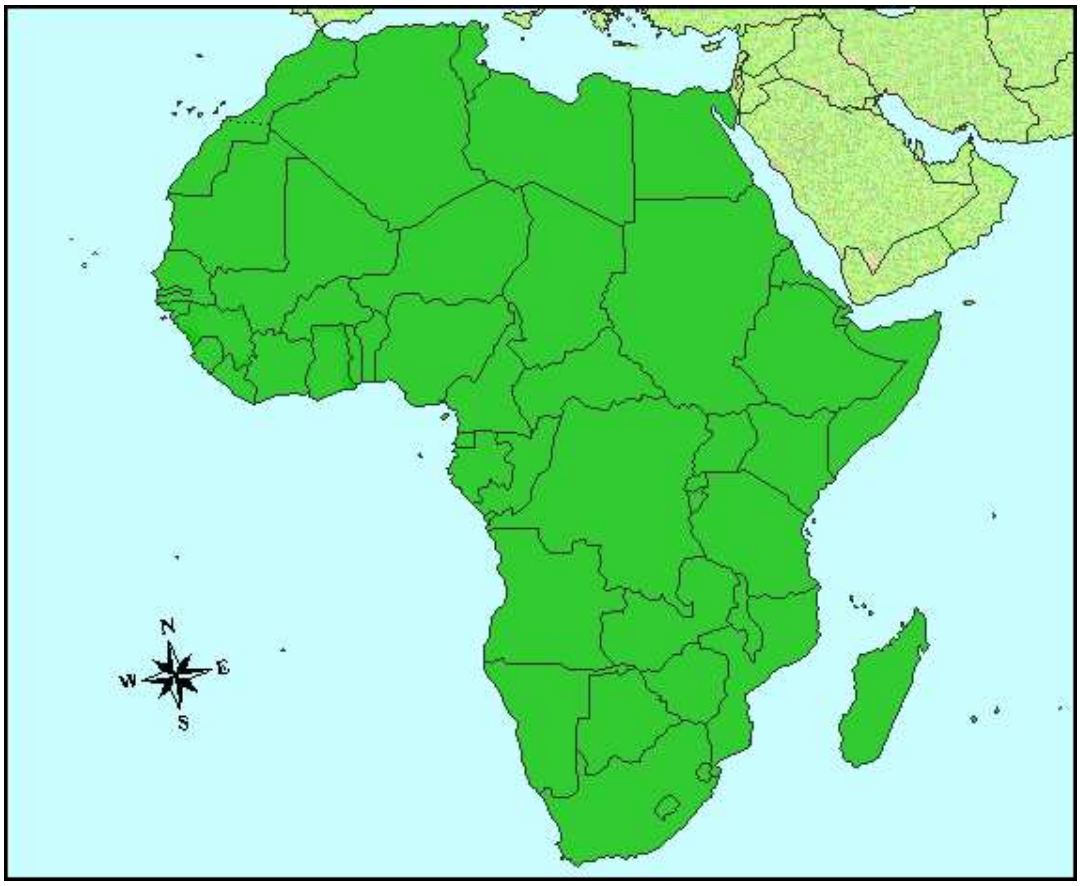
Table 1.1 Countries included in the Ramsar region of Africa

East Africa	North Africa	West Africa	Central Africa	Southern Africa
Djibouti	Algeria	Benin	Burundi	Angola
Eritrea	Egypt	Burkina Faso	Cameroon	Botswana
Ethiopia	Libya	Cape Verde	Central African rep.	Comoros
Kenya	Morocco	Cote d'Ivoire	Chad	Lesotho
Seychelles	Tunisia	Gambia	Congo – Dem. Republic.	Madagascar
Somalia	Western Sahara	Ghana	Congo – republic of	Malawi
Sudan		Guinea	Equatorial Guinea	Mauritius
Tanzania		Guinea-Bissau	Gabon	Mozambique
Uganda		Liberia	Rwanda	Namibia
		Mali	Sao Tome & Principe	South Africa
		Mauritania		Swaziland
		Niger		Zambia
		Nigeria		Zimbabwe
		Senegal		
		Sierra Leone		
		Togo		

[Note: a duplicate entry for Somalia was removed and the above table was sorted, after publication of the 2nd ed. GRoWI CD-ROM]

This review was based on national datasets (including the possibility that a composite national dataset could be amalgamated by equivalent, e.g. provincial, data subsets). From the beginning, the assumption was made that significant (national) information on wetland extent, health, attributes and values might be found in many other information sources besides conventional wetland inventories or directories. It is believed that this constitutes a divergence from previous studies. While this broadened the scope and potential of the material examined, it also meant that all studies were effectively judged as if they were undertaken with wetland inventory objectives in mind. Often, of course, this was not the case.

Furthermore the authors acknowledge the following deficiencies in this study. The dataset is incomplete, for some countries this is more of a concern than for others. The compressed time frame and limited resourcing for a project of this nature probably promoted certain biases (for example, over-reliance on English language studies, and on the more-familiar elements of contact networks), and was likely heavily influenced by the lag time between requests for study material, and its ultimate receipt. At the time of writing, material suitable for assessment continues to be identified and arrive, and the knowledge of other as yet unobtained resources which should be evaluated, increases. Finally, due to time and resource constraints, spatial information datasets have not been adequately reviewed; this constitutes a large gap in this preliminary study.



Boundaries are not authoritative

Figure 1.1 Map of the Africa region

2 Information sources

2.1 Search strategy

This review can simply be described as an inventory of wetland inventories based on national datasets (including composite national datasets that were amalgamated from equivalent, e.g. 'provincial', data subsets).

Potential sources of wetland inventory data were identified through communications with an extensive network of contacts (Annex 1), and using the World Wide Web, external (e.g. Wageningen Agriculture University databases) and in-house libraries, Ramsar National Reports and IWRB National Reports. Key words used in literature searches included combinations of the more obvious terms such as:

> *wetland, wetlands, inventory, extent, status, distribution, classification, directory, overview, review*

and habitat names including the following:

> *coral, reef, mangrove, mangal, grasslands, peat, peatland, bog, marshes, swamp, lakes, dambos, water, reservoirs, pond*

and less obvious terms such as:

> *survey, area, intertidal, subtidal, riparian, aquatic, coastal, evaluation, mapping, floodplain, census, state, waterfowl, waterbirds*

also non-English search terms included:

> *Les zones humid, Le zone umide, zones humides d'importance, Flussordnungszahlen, los manglares, Le Littoral, los Humedales, resources cotieres*

Where the above terms did not prove successful for any individual country, a search by country name was conducted followed by a lengthy examination of the resulting 'hits'.

In addition, the reference lists of material obtained were scanned for possible wetland inventory sources. In many cases this proved to be a more successful approach for identifying potential information sources than database or web searching, particularly for unpublished sources.

2.2 Evaluation of the African dataset

The methodology used to identify and evaluate material for the African dataset follows.

2.2.1 Evaluation of inventory material for inclusion in the AFRICA dataset

Many potential sources were obtained, and their suitability for inclusion in the database was assessed. Those that were deemed as useful were included in this review.

The decision whether to include or exclude certain sources depended on several factors. Poor quality material was not usually included except where no alternative data for a country could be obtained. Sub-national data were excluded except where no national information existed. In cases where material was encountered which contained no area data but did contain other useful information, it was considered if no other information for that country was identified.

2.2.2 Meta-data recording

Each assessed information source was evaluated using a *Wetland Inventory Assessment Sheet* (WIAS) designed to permit rapid assessment and compilation of information about each identified inventory and to compile summary information about the wetland resource contained in each inventory. A set of guidelines for the completion of the sheet was also developed to facilitate consistent handling and coding of relevant information. Derivation of wetland coverage estimates and other wetland parameters are discussed in later sections.

A database was created to include information about each information source that was reviewed and recorded on a WIAS datasheet. Another database was also created to serve as a data dictionary of the codes (and their descriptions) which was used to represent various categories of information in the primary database.

Computer programs were written to analyse the majority of coded fields in the database. The analyses report on the presence or absence of codes or logical values (by use of a filtering system), and produced printed outputs. These outputs provide the meta-data breakdowns given in this report.

2.3 Materials sourced

Some 28 wetland inventory sources were included in the Africa (AFRICA) dataset. The number of inventories examined per country are given in table 2.1 and are graphically represented in figures 2.1–2.5.

The materials examined included both published (including World Wide Web articles, journal articles and books) and unpublished material, academic material (including peer reviewed material, MSc and PhD theses), governmental and non-governmental material, draft reports, newsletter articles, conference proceedings and consultancy reports (see section 2.4 for further details).

As such, conventional wetland inventories and directories were examined, also natural resource inventories or habitat surveys (which either directly or indirectly included wetlands) and sources which contained wetland extent information merely as a by-product of some other activity (e.g. waterfowl counts).

Table 2.1 Numbers of material sourced per country in the African region

West Africa	**No. of Materials Sourced**
Mauritania	6
Senegal	7
Gambia	6
Ghana	5
Guinea	7
Guinea-Bissau	5
Sierra Leone	3
Liberia	4
Cote d'Ivoire	4
Benin	3
Togo	2
Niger	2
Nigeria	4
Burkina Faso	2
Mali	3
Cape Verde	0
Southern Africa	
South Africa	5
Botswana	3
Lesotho	1
Swaziland	1
Namibia	4
Angola	3
Mozambique	2
Malawi	2
Madagascar	4
Zambia	2
Zimbabwe	1

Southern Africa cont	
Mauritius	0
Comoros	2
Central Africa	
Central African Republic	1
Congo – Republic of	3
Congo – Democratic Republic.	3
Burundi	1
Rwanda	1
Equatorial Guinea	2
Gabon	6
Cameroon	4
Sao Tome & Principe	0
Chad	2
North Africa	
Algeria	3
Morocco	3
Egypt	3
Libya	2
Western Sahara	1
Tunisia	6
East Africa	
Tanzania	3
Somalia	2
Eritrea	1
Ethiopia	1
Djibouti	2
Kenya	4
Seychelles	1
Uganda	3
Sudan	2

[Note: a duplicate entry for Somalia was removed above after publication of the 2nd ed. GRoWI CD-ROM]

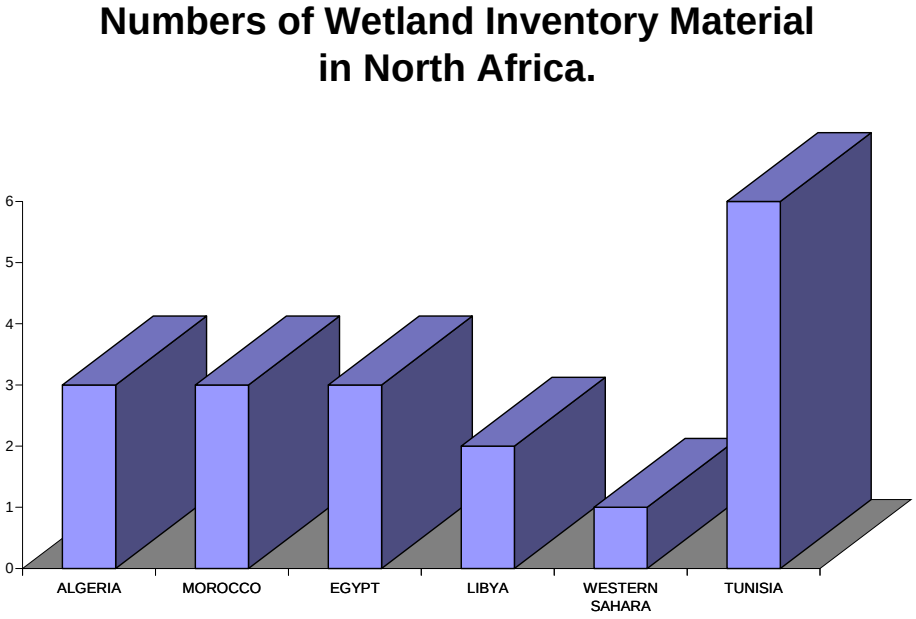


Figure 2.1 Numbers of wetland inventory material examined for the North African countries of the African dataset

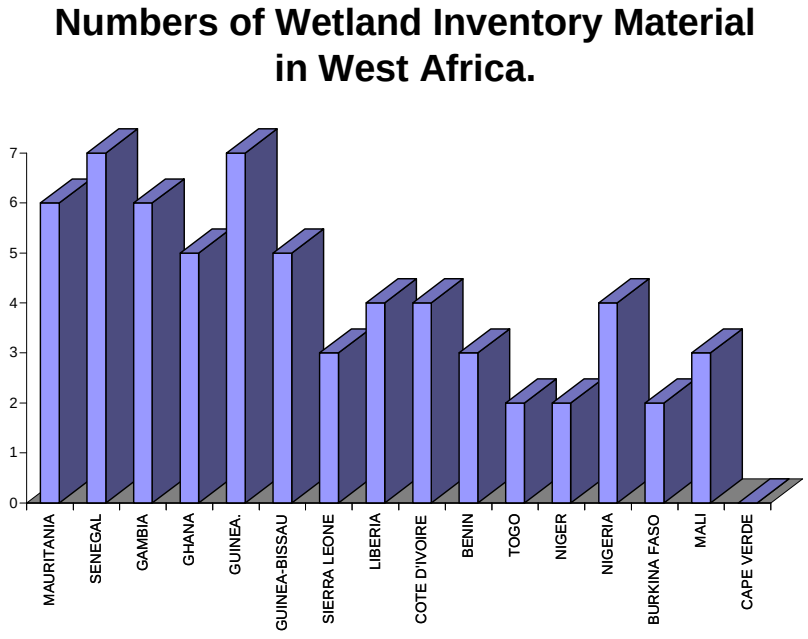


Figure 2.2 Numbers of wetland inventory material examined for the West African countries of the African dataset

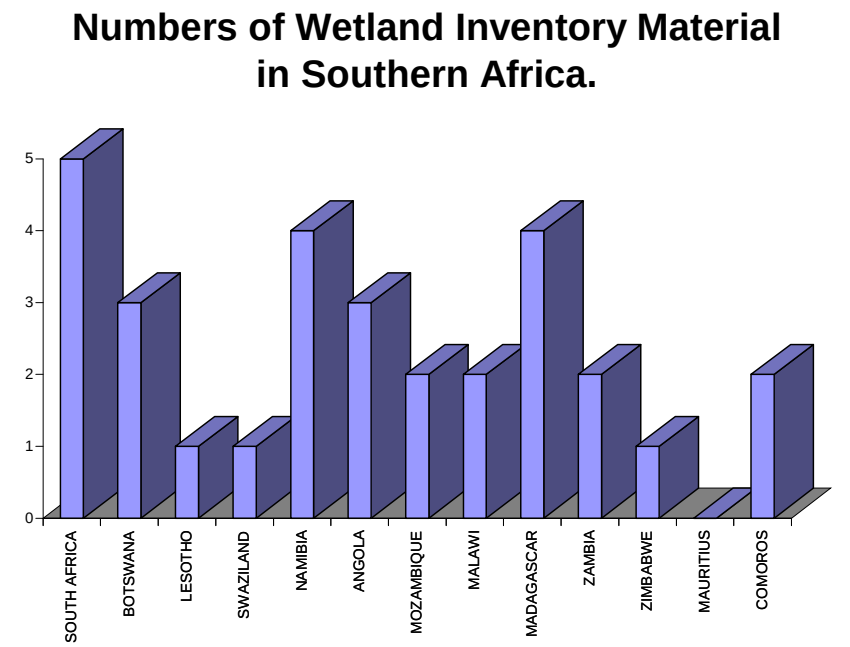


Figure 2.3 Numbers of wetland inventory material examined for the Southern African countries of the African dataset

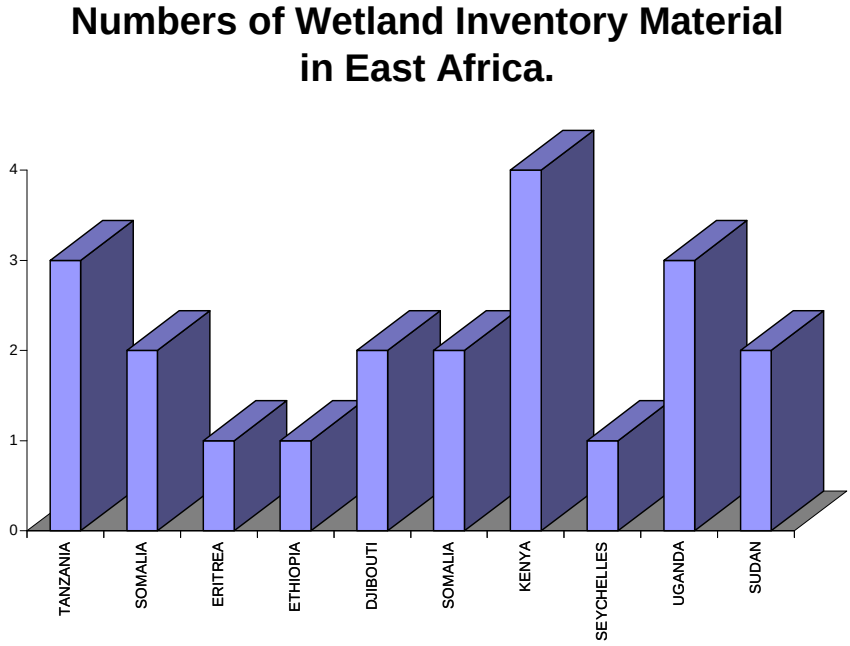


Figure 2.4 Numbers of wetland inventory material examined for the East African countries of the African dataset

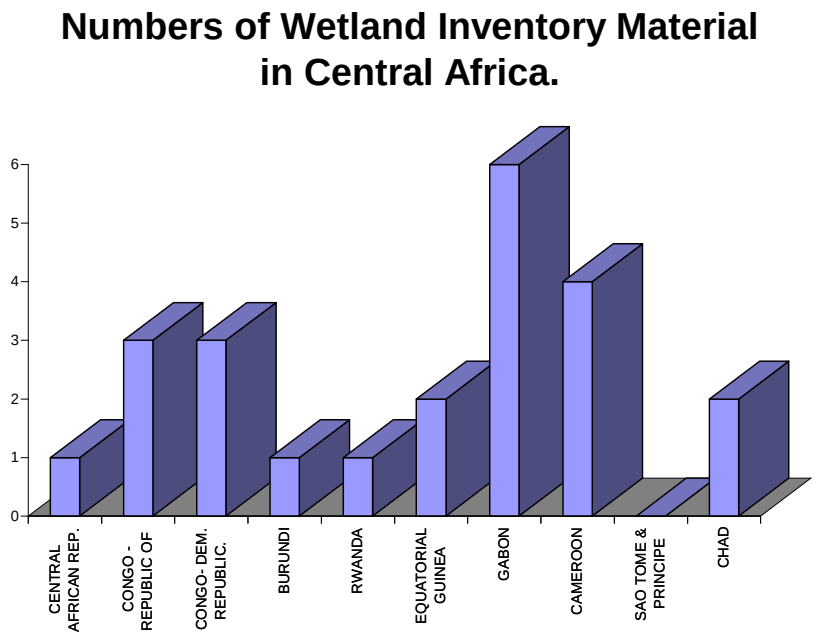


Figure 2.5 Numbers of wetland inventory material examined for the Central African countries of the African dataset

Since a degree of selection occurred in choice of material included in the Africa (AFRICA) dataset, it cannot be stated that 'x' countries have more wetland inventory material than 'y' countries. In some cases, several sources of material were required in order to make a best estimate of wetland coverage for a specific country, whereas, for other countries, one source alone was comprehensive and detailed enough to provide a best estimate of wetland coverage.

An example of the former would be Mauritania; five separate source materials were examined for Mauritania and, yet, no values for wetland area by type were possible, and the value for total wetland coverage is very approximate. An example of the latter would be 'A directory of South African wetlands' in Cowan (1997). Therefore, it must be noted that the bar graphs above cannot be taken as representative of all the material available per country, simply the material which was included in the AFRICA dataset.

2.4 Summary of information sources reviewed

The majority of materials examined (75%) were national level material and some 11% were at the global scale, and some 11% were at the sub-regional scale (ie covering several countries within the Africa Ramsar region, though not covering every country in the region).

Scale of inventory of material	
Global scale	11%
Supra-regional scale	7%
Regional scale	4%
Sub-regional scale	11%
National scale	75%
Single country studies	68%
National scale references including more than one country	7%

Sub-national scale	0%
National and other scale combination	7%

A large percentage of materials (32%) was produced by non-government organisations (NGOs), composed of 11% of formal NGO publications and 21% NGO reports. Government produced material amounted to a further 32% of material (25% formal government publications and 7% internal government reports). Some 7% of material came from peer review journals, 4% came from chapters in published books and a further 7% were academic theses (both PhD and MSc).

Type of source material	
Peer review journals	7%
Peer review books	0%
Chapters in books	4%
Conference or keynote presentation	0%
Article in conference proceedings	0%
Internal government reports	7%
Government formal publications	25%
Other government material	4%
NGO reports	21%
NGO formal publications	11%
Consultancy reports	0%
Newsletter articles	0%
Practitioner periodical article	0%
Database manual	0%
Electronic database	4%
World Wide Web article	0%
Thesis	7%
Other	11%
Unknown	4%

Most of the information sources examined were not conventional wetland directories or inventories (71%); the majority of information sources were other kinds of studies, and not wetland inventories *per se*.

Source is a directory/inventory or equivalent?	
Yes	29%
No	71%

The majority of studies examined were in English (86%), with the remaining sources being mainly in French.

Language of study	
English	86%
Other	14%

Nearly all the material was in paper format (96%) and, notably, none of the material was produced electronically on the World Wide Web. This should be compared to Western and Eastern Europe which both produced some information on the World Wide Web (Stevenson & Frazier 1999a,b). Similarly, most information (82%) was stored in paper format, and some 11% in electronic databases.

Format of study	
Paper	96%
Electronic text	0%
Electronic database	7%
Personal communication	0%
Web presentation	0%
Part of GIS or GIS output	4%
Map based	0%
Other format	0%
More than one format	4%
Data storage media	
Paper	82%
Web (electronic)	0%
Other electronic (not web or database)	4%
Electronic database	11%
GIS	4%
Hard copy map	0%
Digitised map	0%
Other	18%
Unknown or ambiguous	21%
More than one medium	11%

Only 43% of the material was published, but 46% of the material was classed as ‘unpublished but unrestricted’.

Circulation of study	
Published	43%
Interdepartmental (unpublished)	4%
Internal (unpublished)	7%
Restricted (unpublished)	0%
Unrestricted (unpublished)	46%
Other types	4%
Unknown	4%
More than one type	7%

2.5 Reliability of data

It is difficult to make judgements on the reliability of the individual data sources examined and included in this review when much of the material did not provide basic information. For instance, basic information such as the date of survey or date ranges of material featuring in a compilation/review, methodologies used, or contact information was frequently omitted. The tendency is to judge material as unreliable if it does not contain such basic information, but this judgement is by no means certain. The variety of classification schemes and definitions of wetlands used (often not defined) serves to further hamper any attempts to judge the reliability of the material. However, as material for individual countries is judged collectively, it becomes (subjectively) more clear which information sources are likely to be more reliable.

By examining the methods, the date ranges and inclusion (or exclusion) of particular wetland types it is possible to at least generate best estimates of wetland coverage for any particular country, by consolidating the estimates from several sources. For example, one source may provide an estimate of wetlands in a country comprising an estimate of coastal wetlands which appears to be accurate, but an estimate of freshwater wetlands which noticeably excludes (for example) floodplains. The estimate for coastal wetlands would then be consolidated with the estimate of freshwater wetlands provided by another source that purports to include floodplain wetlands (providing it was a greater area than the other source).

Section 3.3 provides a more detailed description of how wetland area estimates by type were generated for this review, and provides guidance for interpreting the summary sheets of wetland coverage and extent (Annex 2), and material reviewed. Comments on the age of data, methods used and exclusions in coverage (e.g. the estimate excludes floodplain wetlands and ephemeral wetlands).

Several generic difficulties emerged throughout the evaluation process that should be noted when judging the reliability of data. These are summarised below.

- usage of different wetland definitions/classifications and the inclusion or exclusion of some wetland types, e.g. lakes and open water, in inventories. Certain wetland types are frequently excluded from wetland assessments such as dune slacks, humid sands, dambos, wet mesotrophic grasslands, seagrass beds, maerl beds, ephemeral wetlands, and coral reefs;
- artificial wetlands were also often largely ignored in many national inventories and therefore national inventories are often incomplete in their coverage;
- the date of data collection and inventory productions were often not recorded, and it should be noted that review compilations by their very nature use different sources of widely differing ages (the dates of which are rarely stated);
- recent changes in political/national boundaries made older sources difficult to interpret;
- defined boundaries of wetlands were often not provided, making comparisons between different sources difficult, as did the variable treatment of individual wetlands in wetland complexes;
- many sources lacked a summary, making extracting national-level information time-consuming; some of the material which did provide a summary contained summary information that did not always match the text of the report;
- many potential wetland inventory information sources were unpublished material which proved to be difficult to obtain or access; much of the information which was accessed

were also draft reports written up to 5 years ago which have never progressed beyond draft report stage;

- often the areas provided in many sources of information were site areas, e.g. national park areas and not actually wetland areas, (these sources were excluded from the analysis, with the exception of Ramsar sites which were recorded separately for interest);
- contradiction of information about some sites *between* different references was found to occur. With a little detective work, in most cases it was possible to identify erroneous material, but this was not always possible;
- contradictions within *one individual* source document were also noted. This meant that some detective work was required to identify errors and rectify errors, resulting in slow assessment.

This project has identified several cases where source material has quoted wetland area estimates taken from studies that had been comprehensively updated by more recent studies, and therefore their estimates were out of date, and had been supplanted by more recent and accurate data. This creates a misinformation trail, which makes it difficult to assess the accuracy of reports that yield conflicting data.

Some less accessible inventories have been missed in this review. Additional material has been identified since the analysis phase was completed and some key sources of material were therefore not incorporated in this preliminary analysis. Further additional sources may be revealed during the consultation phase and after circulation of the completed report. An update of the dataset is recommended after the consultation process has been completed.

3 Extent and distribution of wetlands

3.1 Definition and classification of wetlands

A major consequence of using the rather broad Ramsar definition of wetlands in this review (Annex 3) is that the estimates of wetland coverage generated by this project cannot strictly be regarded as estimates of true or actual wetland cover, but are instead estimates of *described* wetland cover. Consequently the area values given in this review should be viewed as underestimates, and do not represent estimates of the entire wetlands resource, but only those for which coverage estimates already exist in their many disparate forms.

Differing wetland definitions and classification schemes were used in different studies and these definitions are not always stated, making it difficult to assess the degree of completeness of cover (and thereby the estimates of wetland extent). For instance, many inventories include or exclude some wetland types, e.g. open water bodies, and estuaries.

A definition of the terms ‘marine wetlands’, ‘coastal wetlands’ and ‘inland wetlands’, was almost without exception absent, and yet separate authors used them to mean different things. Extracting information on even broad wetland categories was found to be difficult. Particularly when some authors use, for example, the term ‘coastal wetlands’ to mean strictly saline and brackish habitats and others use it to mean wetlands in the coastal zone (which often for practical purposes means coastal lowlands and incorporates wetlands which experience no tidal inundation). Similarly the term ‘inland wetlands’ to some authors meant freshwater wetlands, to others it meant all wetlands except those in the coastal plain, to others it meant all wetlands except those wetlands under tidal influence.

It was apparent (though not defined) that many authors utilised a more narrow definition of wetlands than that given by the Ramsar definition. For instance, many authors may argue that

wetlands must be vegetated, (therefore mudflats and sand flats and open water would be excluded). Others may argue that coral reefs, seagrass beds and subterranean karst are not wetlands, and others may also exclude artificial or created wetlands from their definition of wetlands. Similarly, forested wetlands are often regarded as forests and not wetlands, and are therefore excluded from wetland assessments (and yet may also be excluded from forestry assessments for exactly the opposite reason).

It is therefore not surprising that certain wetland types were noted to be commonly excluded from wetland assessments. These include dune slacks, humid sands, dambos, wet mesotrophic grasslands, seagrass beds, maerl beds, coral reefs, and artificial wetlands (especially reservoirs, fish ponds, rice paddies, dams etc).

A definition of wetlands was provided in only 32% of studies, and only 50% of studies used the Ramsar definition of wetlands, (though it was unknown for 43% of studies, so the true value may be much higher). The Ramsar classification system for wetland type was used in 21% of studies; it was unknown for 36% of studies and not applicable for some 29% of studies (these were usually reviews or collations of material).

Wetland definition	
Definition provided	32%
Definition implied	36%
No definition provided or implied	29%
Unknown/ambiguous	4%
Ramsar definition	
Ramsar definition used	50%
Ramsar definition not used	7%
Use of Ramsar definition unknown	43%
Ramsar classification	
Ramsar wetland types used	21%
Other wetland classification used	7%
Wetland classification varies	7%
Unknown	36%
Not applicable	29%

3.2 Overall extent of wetlands in Africa

In 64% of studies, part of the wetland resource was examined, whereas all wetland resources were included in just 36% of studies; for some 4% of the studies it was ambiguous whether all or part of the national wetland resources were included. Where only part of the wetland resource was assessed by a study, (64% of studies) the basis for selection was varied, and included landform type (e.g. coastal wetlands, or inland wetlands), or habitat type (e.g. mangrove, peat, marsh), or floral/faunal groups (e.g. wetlands of importance to birds, crocodiles, fisheries).

Extent of coverage	
All wetlands	36%
Part of wetland resource	64%
Ambiguous	4%

Wetland type coverage	
Sources providing area values per wetland type	39%
Sources partially providing area values per wetland type	39%
Sources not providing area values per wetland type	14%
Not known	7%
Basis of selection (if not complete wetland coverage)	
Geography/jurisdiction	25%
Land cover or remotely sensed data	0%
Landform type	25%
Supra-habitat	4%
Habitat type	11%
Floral/faunal groups or species	14%
Climate	4%
Wetland function	0%
Hydrology	7%
Biodiversity value	4%
Cultural value	0%
Artefact of data collection	11%
Other basis	11%
Unknown or ambiguous	0%
More than one basis	43%

A summary of wetland coverage in Africa is presented in tables 3.1 and 3.2 below. The total area calculated by the AFRICA dataset amounted to some 121 322 000–124 686 000 ha, covering 4% of the land surface. As would be expected, more than 85% (107 051 000–107 546 000 ha) of these were inland wetlands, with less than 10% described as marine/coastal wetlands (8 981 000–11 256 000 ha) and a further 5% described as artificial wetlands (4 591 000–4 658 000 ha).

Since the scope and coverage of most inventory material did not state whether total wetland estimates included Ramsar sites, it is not possible to state whether this value includes, partially includes or excludes these sites. It must also be noted that the area values shown for Ramsar sites given in table 2.2 are the site area and not the wetland area. A good example of this would be the Okavango Delta Ramsar site, which is larger in extent than the estimate for total wetland area in the whole of Botswana.

Table 3.1 Wetland coverage in Africa as identified by the Africa dataset

Africa	**Estimate of area in hectacres (ha)**
Marine/coastal wetlands	8 981 376 – 11 256 398
Inland wetlands	107 050 527 – 107 545 899
Manmade wetlands	4 590 892 – 4 657 892
Area of unspecified types of wetland	698 888 – 1 226 000
Total area of wetlands identified in this study	121 321 683 – 124 686 189
# of national datasets per Region	121
# of national datasets which can be regarded as	33*

comprehensive in cover

[*Note: the value "33" above represents a correction effected after publication of the 2nd ed. GRoWI CD-ROM]

Table 3.2 Wetland coverage in Africa as a percentage of land cover, and Ramsar site information

Africa	
# of countries	54*
Total land area of region (ha)	3 033 500 000
% of land area covered by these wetlands	4.05%
Total area of Ramsar sites (ha)	13 964 807
# of Ramsar sites	74

(Source of Ramsar site information: Ramsar Database, date of data extraction 17/8/98)
[*Note: the value "54" above represents a correction effected after publication of the 2nd ed. GRoWI CD-ROM]

3.3 Wetland extent in African countries

Best estimates of wetland extent by broad wetland type ('inland', 'marine/coastal' and 'artificial') for the African countries are given in table 3.4. A description of how best estimates of wetland coverage per country were derived is outlined below.

3.3.1 Derivation of country 'best estimates' of wetland coverage

The estimates of wetland coverage cited in the material examined in this review (and included in the African dataset) were entered into a system of *country coverage files* (in spreadsheet format). An individual wetland coverage file for each country within the region was created to facilitate the generation of best estimates of wetland area coverage per country and to serve as a summary and provide an 'audit trail' of material included.

Each file (workbook) consisted of several components (worksheets) broken down by Ramsar wetland type and also by broad wetland category (marine/coastal, inland and artificial) as follows:

1 Sheet one contains area statistics for marine/coastal wetlands broken down by Ramsar wetland type (*types: A, B, C, D, E, F, G, H, I, J, K).*

2 Sheet two contains area statistics for inland wetlands broken down by Ramsar wetland types (*types: L, M, N, O, P,Q, R, Sp, Ss, Tp, Ts, U, Va, Vt, W, Xf, Xp, Y, Zg, Zk).*

3 Sheet three contains area statistics for artificial wetlands broken down by Ramsar wetland types (*types: 1, 2, 3, 4, 5, 6, 7, 8, 9,).*

4 Sheet four contains 'notes and comments' which provides an indication of the reliability of the data (subjective assessment), and notes about methodology and or original sources of data.

5 Sheet five 'summary' contains the *total* values for 'marine/coastal', 'inland' and 'artificial' wetlands (not broken down per Ramsar wetland type) and the 'notes and comments' sheet. This sheet is generated automatically from sheets 1–4. Changes made to sheets 1–4 will update in the summary sheet.

The summary sheet (sheet five) for each country can be found in Annex 2. Where possible, approximate estimates per Ramsar wetland type were entered in the appropriate columns (in sheets 1–3. Where this was not feasible, approximate values for broad wetland type were entered and where this was not feasible, a total value was entered. This created a hierarchical

system where it was possible to examine the quality of wetland coverage and extent information per country, which was assessed in the African dataset.

Each file provided wetland estimates, along with brief notes as to scope, and in particular, exclusions in coverage (e.g. open water bodies), and gave an indication as to the reliability of the data (sheet 4). This provided a convenient means of auditing all the material included in the dataset, and provides an 'at a glance' summary of the material examined.

Once all the wetland area values had been entered into a coverage file for each country, along with the appropriate notes on method and reliability, a subjective assessment of all material for each country was made. Best estimates were composed according to broad wetland category (marine/coastal, inland and artificial), and a justification of the rationale entered into sheet 5. Once the coverage files were completed for all the countries within a region, the estimates were compiled into a summary table (given in table 3.4).

It should be noted that several wetland inventories included information on more than one country, and hence these documents featured in many country coverage. The number of materials (referred to as datasets) examined per country were totalled and also entered into the summary document for each region.

Please note: there are some notes which will appear on summary sheet five which refer to specific Ramsar wetlands or values shown on sheets 1–4 (in the individual country coverage files as described above). In a small number of cases the notes appearing on the summary sheet are not self-explanatory when viewed independently of sheets 1–4. This is regrettable but unavoidable given the time constraints associated with the production of national overviews.

The summaries of wetland coverage for each African country deemed to have sufficient material to generate a 'best estimate' of wetland coverage either in total or by category type (inland, marine/coastal, artificial) can be found in Annex 2. Notes on the reliability of the assessment are included with each summary. Countries that were omitted from the 'best estimate' and reliability assessment due to lack of data in the AFRICA dataset are given below in table 3.3.

Table 3.3 Countries omitted from the 'best estimate' and reliability assessment due to lack of data in the AFRICA dataset

Africa	
Cape Verde Islands	Mauritius
Comoros	Sao Tome and Principe
Ethiopia	Seychelles

3.3.2 'Best estimates' of wetland coverage per country

'Best estimates' of Wetland coverage per broad wetland category for countries in the Africa region are given in table 3.4

Table 3.4 Best estimates of wetland coverage per broad wetland category for countries in the Africa region*

AFRICA REGION		BEST ESTIMATES				COVERAGE INFO		RAMSAR INFO	
	Marine/coastal (ha)	Inland (ha)	Artificial (ha)	Unspecified wetland type (ha)	Total (ha)	# of datasets accessed per country[1]	# of datasets which can be regarded as comprehensive in cover per country	Total area of Ramsar sites	# of Ramsar sites
ALGERIA	121 380–134380	585 500	8 000		714 880–727 880	3	2	4 900	2
ANGOLA	70 000–110 000	400 000	unknown		470 000–510 000	3	1	0	0
BENIN	175 790	129 000	unknown		304 790	3	1	0	0
BOTSWANA	None	2 243 250	4 405		2 247 655	2	1	6 864 000	1
BURKINA FASO	Unknown	364 958	unknown		364 958	1	1	299 200	3
BURUNDI	None	499 000	unknown		499 000	1	1	0	0
CAMEROON	300 000	2 255 613	unknown		2 555 613	4	1	0	0
CAPE VERDE	no data	no data	no data		No data	0	0	0	0
CENTRAL AFRICAN REPUBLIC	None	3 150 000	unknown		3 150 000	1	0	0	0
CHAD	None	12 983 390	1 666 000		14 649 390	1	1	195 000	1
COMOROS	no data	no data	no data		No data	0	0	30	1
CONGO - DEM. REPUBLIC OF	37 400	14 551 095	unknown		14 588 495	3	1	866 000	2
CONGO - REPUBLIC OF	740 000	11 686 500	unknown		12 426 500	2	0	438 960	1
COTE D'IVOIRE	292 330	unknown	105 000–172 000		397 330–464 330	3	0	19 400	1

*Please consult 3.3.1 for a description of how these estimates were generated

Table 3.4 cont

		BEST ESTIMATES				COVERAGE INFO		RAMSAR INFO	
AFRICA REGION	**Marine/coastal (ha)**	**Inland (ha)**	**Artificial (ha)**	**Unspecified wetland type (ha)**	**Total (ha)**	# of datasets accessed per country[1]	# of datasets which can be regarded as comprehensive in cover per country	Total area of Ramsar sites	# of Ramsar sites
DJIBOUTI	1 000	37 200	unknown		unknown	2	0	0	0
EGYPT	2 634 550	711 200	unknown		3 345 750	2	0	105 700	2
EQUATORIAL GUINEA	27 700	unknown	unknown		27 700	2	0	0	0
ERITREA	58 100	unknown	unknown		58 100	1	0	0	0
ETHIOPIA[2]								0	0
GABON	175 900–257 500	3 968 875	unknown		4 144 775–4 226 375	5	0	1 080 000	3
GAMBIA	74 700	106 608	unknown		181 308	5	0	20 000	1
GHANA	117 800	460 050	895 225		1 473 075	4	1	178 410	6
GUINEA	250 000	121 500	unknown		371 500	5	0	225 011	6
GUINEA-BISSAU	200 000–364 900	unknown	unknown		200 000–364 900	4	0	39 098	1
KENYA	96 100	2 641 690	unknown		2 737 790	3	1	48 800	2
LESOTHO	None	unclear	unclear	20 000	20 000	2	0	0	0
LIBERIA	42 700	unknown	9 000		51 700	3	0	0	0
LIBYA	Unknown	unknown	unknown		unknown	1	0	0	0

1 Excluding the Ramsar sites and GLCC databases

2 Data exist but for pre-Eritrean independence only; substantial map work would be required to ascertain coverage data for Ethiopia.

Table 3.4 cont

		BEST ESTIMATES				COVERAGE INFO		RAMSAR INFO	
AFRICA REGION	**Marine/Coastal (ha)**	**Inland (ha)**	**Artificial (ha)**	**Unspecified wetland type (ha)**	**Total (ha)**	# of datasets accessed per country1	# of datasets which can be regarded as comprehensive in cover per country	Total area of Ramsar sites	# of Ramsar sites
MADAGASCAR	340 300–371 747	340 000	32 300		712 600–744 047	4	0	0	0
MALAWI	None	2 248 150	unknown		2 248 150	1	0	224 800	1
MALI	None	3 560 400	69 000		3 629 400	2	1	162 000	3
MAURITANIA	Unknown	unknown	unknown	668 888–1 196 000	668 888–1 196 000	5	2	1 188 600	2
MAURITIUS	no data	no data	no data		No data	0	0	0	0
MOROCCO	29 300-33 200	27 800–43 800	7 500		64 600–84 500	2	2	10 580	4
MOZAMBIQUE	345 900	1 950 785	266 500		2 563 185	2	1?	0	0
NAMIBIA	6 500*-9 850	1 322 160–1 353 660	7 533		1 336 193–1 371 043	3	0	629 600	4
NIGER	None	1 764 950	unknown		1 764 950	1	0	220 000	1
NIGERIA	1 346 775–3 238 000	5 527 060	123 000		6 996 835–8 888 060	4	1	0	0
RWANDA	Unknown	348 100	unknown		348 100	1	0	0	0
SAO TOME & PRINCIPE	no data	no data	no data		No data	0	0	0	0
SENEGAL	508 000	663 000	unknown		1 171 000	5	2	99 720	4
SEYCHELLES	no data	no data	no data		No data	0	0	0	0
SIERRA LEONE	170 600	108 820	unknown		279 420	2	1	0	0
SOMALIA	91 000	600 000	unknown		691 000	2	1	0	0
SOUTH AFRICA	276 367	276 911	201 262		754 540	3	2	489 998	16

Table 3.4 cont

		BEST ESTIMATES				COVERAGE INFO		RAMSAR INFO	
AFRICA REGION	**Marine/Coastal (ha)**	**Inland (ha)**	**Artificial (ha)**	**Unspecified wetland type (ha)**	**Total (ha)**	# of datasets accessed per country1	# of datasets which can be regarded as comprehensive in cover per country	Total area of Ramsar sites	# of Ramsar sites
SUDAN	93 700	4 155 900	311 500		4 561 100	2	1	0	0
SWAZILAND	–	unclear	unclear	10 000	10 000	1	0	0	0
TANZANIA	200 000–245 600	8 389 286	85 000		8 674 286–8 719 886	4	2	0	0
TOGO	44 400	73 200	unknown		117 600	1	1	194 400	2
TUNISIA	113 084	1 182 915–1 207 915	20 787		1 316 786–1341 786	3	2	12 600	1
UGANDA	None	4 451 703–4 874 575	unknown		4 451 703–4 874 575	2	1	15 000	1
WESTERN SAHARA	Unknown	72 430	unknown		72 430	1	0	0	0
ZAMBIA	None	11 733 028	454 200		12 187 228	2	1	333 000	2
ZIMBABWE	None	1 358 500	324 680		1 683 180	2	1	0	0
Total estimated wetland cover	**8 981 376–11 256 398**	**107 050 527–107 545 899**	**4 590 892–4 657 892**	**698 888–1 226 000**	**121 321 683–124 686 189**	**121**	**33**	**13 964 807**	**74**

[*Note: the value for Marine/Coastal hectares for Namibia in the above table has been corrected by removal of an extraneous "0" since publication of the 2nd ed. GRoWI CD-ROM. This change was cosmetic, having no impact on related calculations].

4 Rate and extent of wetland loss and degradation

The majority of sources examined (86%) did not provide any details of wetland loss and/or degradation. This does not mean that loss values do not exist, simply that the material sought for this review was wetland inventory material, which as it turned out, rarely dealt with these issues in any detail. No specific tasks were performed to identify material which specifically outlined as wetland loss (in isolation of inventories/directories). Thus, wetland inventory material within the Africa region does not normally include any appreciable data on wetland loss. This may, however, be directly related to the time scale of most wetland inventory activities, which are largely discrete surveys, which have not yet been repeated.

Of the 11% of material in the Africa region which did provide some information, this was almost exclusively descriptive, rather than quantitative. It was therefore not possible to either refute or support the values given by OECD (1996) which suggest that overall wetland loss in tropical and sub tropical Africa is 2%. However, in certain areas it is known that wetland loss is much greater than this. For instance, Taylor et al (1995) provide loss figures for two areas in South Africa: firstly for the Tugela Basin (in Natal), where over 90% of the wetland resources have been lost in parts of the basin; and secondly for the Mfolozi catchment (10,000 km^2), where 58% of the original wetland area (502 km^2) was estimated to have been lost. Similarly, Hollis (1993) reports an overall loss of 15% of wetland area and 84% loss in the Medjerdah catchment in Tunisia.

Wetland loss and degradation	
Sources providing information on wetland loss and or degradation	11%
Sources not providing information on wetland loss and /or degradation	86%
Not known	4%

More recent information on wetland loss may have emerged since the work by Hollis (1993), and Taylor et al (1995). However, the important thing to note is that if the AFRICA dataset is representative of the wetland inventory material that exists in Africa, then we can conclude that wetland loss is rarely measured or recorded during wetland inventory activities in the region. Studies that specifically set out to measure wetland loss may have been undertaken, but loss values do not feature in inventory assessments.

Wetland status description	
Overall wetland status description included	43%
Overall wetland status description not included	57%
Unknown	0%

Similarly, of the material examined for Africa, only 43% of material included a description of overall wetland status in a country (though these descriptions were of course totally generic in nature). Overall those that did provide such information often provided detailed individual site information (often the 'study site' subject to scientific research), and some studies provided an overview or summary of such information. These latter studies were generally not conventional wetland inventories or directories *per se*, and were frequently academic peer review publications, which are necessarily short in length. Where wetland loss information was provided it must be noted that the rates or amounts identified on a local scale do not necessarily reflect national trends in wetland loss. Overall it can be said that the information

on wetland loss was usually lacking, but where it was included it was highly variable and inconsistent in its detail.

Details of the major threats to wetlands are also lacking from most inventory material in the Africa region. Some site based studies do provide very brief descriptions of threats to individual wetlands; usually these studies are ones undertaken to designate or describe wetlands of 'international importance' (according to the Convention on Wetlands, Ramsar, 1971). Standard site descriptions are recorded on a Convention-approved form, the 'Ramsar Information Sheet' (RIS) and this *proforma* includes an information category called 'Adverse factors'. This subject is recorded in the Ramsar Database according to an ad hoc set of past (but still influential), present and/or potential wetland threats (both in and around the site). These were based on the data that have been provided, rather than fitting incoming data to a pre-existing structured classification.

Due to this historical legacy, the urgency, extent and character of any threat at any site listed has never been codified in the current (to be supplanted) database. Such information, if it exists, might be found in individual site files which support the database. Frequently, the level of detail provided is very low. Example statements include 'timber extraction from the mangrove is common at the site', 'charcoal production occurs on a large scale', 'livestock grazing is causing physical damage to the wetland', and 'water extraction for agricultural purposes is leading to a lowering of the water table'. Quantification of threats or losses was not given in any of the studies examined.

5 Wetland benefits and values

Wetland values as defined under the Ramsar Convention are:

> the perceived benefits to society, either direct or indirect, that result from wetland functions. These values include human welfare, environmental quality, and wildlife support (Ramsar Convention Bureau 1996).

A large proportion of material examined for the review was not a conventional inventory /directory (see section 2.4) and did not contain site by site information. These sources did not usually contain details of wetland values and/or benefits (other than generic statements), since they usually referred to wetlands at a national level (or at least above a local or provincial level) and would therefore not contain detailed management information.

Very few studies contained information on wetland values and benefits. Studies which were not site based inventories (rather general overviews) only contained some level of values and benefits information in 4% of cases.

Africa	**Inclusion of wetland values and benefits information (site based studies only)**
Some level of information (non site based studies only)	4%
Always	4%
Most of the time	11%
Commonly	4%
Sometimes	7%
Rarely	25%
Never	46%
Unknown	0%

Site based studies (usually wetland inventories *per se*) were treated differently in the evaluation process to non-site based studies, and were evaluated against Ramsar Information Sheet (RIS) categories, and the frequency (ie never, rarely, sometimes, commonly etc) of the inclusion of the RIS category recorded. The frequency of inclusion of values and benefits information for *each and every site* described within (site based) studies was assessed. The results showed that 46% 'never' contained any values and benefits information; 'rarely' 25%; 'sometimes', 7%; 'commonly', only 4%; 'most of the time' 11%; and 'always' 4%. In the majority of non-site based studies, a paragraph or two describing values and benefits of wetlands in general was usually all that was provided. None of the material examined included any financial or economic estimates.

In the majority of site based studies (wetland inventories *per se*), values and benefits information amounted to one or two sentences per site (e.g. 'the site experiences pressure from artisanal fisheries', 'the wetland provides flood buffer and water storage capabilities', 'the area is a tourist destination for wildlife viewing'). In the majority of non-site based studies, a paragraph or two describing values and benefits of wetlands in general was usually all that was provided. None of the material examined included any financial or economic estimates.

6 Land tenure and management structures

A large proportion of material examined for the review was not a conventional inventory /directory (see section 2.4) and did not contain site by site information (ie they were 'non-site based studies). These sources did not contain information on land tenure, management authority or jurisdiction, since they usually referred to wetlands at a national level (or at least above a local or provincial level) and would therefore not contain detailed management information.

When material did contain site by site information, the material was evaluated against Ramsar Information Sheet (RIS) categories and the frequency (ie never, rarely, sometimes, commonly, etc) of the inclusion of the RIS category was recorded. As can be seen below, 89% of the time land tenure or ownership information details were never recorded.

Africa	**Inclusion of land tenure/ownership information (site based studies only)**
Some unknown level (non site based studies only)	0%
Always included	0%
Most of the time included	7%
Commonly included	0%
Sometimes included	4%
Rarely included	0%
Never included	89%
Unknown	0%

Similarly, some 89% of the material 'never included' jurisdiction information, or any management authority information.

Africa	Inclusion of jurisdiction information (site based studies only)
Some unknown level (non site based studies only)	4%
Always included	0%
Most of the time included	4%
Commonly included	0%
Sometimes included	4%
Rarely included	0%
Never included	89%
Unknown	0%

NB The Ramsar information sheet states 'Jurisdiction (territorial e.g. state/region and functional e.g. Department Agriculture/ Department of Environment)'

On the whole it can be said very few sources in the Africa region contained information on land tenure, management authority or jurisdiction.

Africa	Inclusion of management authority information (site based studies only)
Some unknown level (non site based studies only)	4%
Always included	0%
Most of the time included	4%
Commonly included	0%
Sometimes included	4%
Rarely included	0%
Never included	89%
Unknown	0%

NB The Ramsar information sheet states 'Management authority: (name and address of local body directly responsible for managing the wetland)'

7 Extent and adequacy of updating programs

The majority (64%) of information examined in this review was published or dated between 1991 and 1995, 14% was published or dated after 1995 and 14% was published or dated between 1986 and 1990. Most of the information (61%) was judged to not have a temporal scale (generally these studies were reviews and collations), and only 32% had defined temporal scale (ie were discrete 'one-off' surveys, or ongoing surveys) with a further 7% unknown.

This at first appears very low, but compares well with the material examined for both Western and Eastern Europe for which only 22% and 7% (respectively) of studies had a defined time scale (whether that meant studies were part of a long-term project or were discrete one-off surveys) (Stevenson & Frazier 1999a,b). It could be that review material (ie secondary material) generally emerges once primary data are more established and available.

Publication date	
After 1995	14%
Between 1991–1995	64%
Between 1986–1990	14%
Between 1981–1985	0%

Unknown / ambiguous	7%
Temporal scale	
Studies with a temporal scale *	32%
Partly include a temporal scale	0%
No temporal scale (e.g. review)	61%
Unknown	7%
** Broken down further:*	
Discrete surveys	29%
Surveys updated on an ad-hoc basis	4%
Update purpose to add sites	4%
Update purpose to review status	0%
Update purpose to make corrections	4%
Other update purpose	0%
Unknown purpose	0%
Current /ongoing surveys	4%
Updated on ad-hoc basis	4%
Updated on annual basis	0%
Frequency of update unknown	0%

It could be argued that low resolution, comprehensive national field surveys should be undertaken (whether remotely or as part of ground surveys) as a priority to at least identify wetland locations for more detailed study later. However, in terms of resource conservation, repetition of detailed surveys at sites thought to be at risk should also be a priority undertaking. One-off surveys for previously unsurveyed areas are critically important in terms of resource assessment, but few surveys examined in this review were found to be part of a long-term assessment or monitoring program.

None of the inventories identified in the region (with the exception of the Ramsar database) have been updated after any given time interval after the first inventory. Wetland inventories must be regularly reviewed and updated otherwise data are likely to be lost, become out of date and become of historical interest only.

It would be overly critical to state that the updating procedures of wetland inventory in Africa are grossly inadequate, since 78% of the studies examined were published after 1991. The wetland inventory process in Africa is still at an early stage of development, and therefore it is unsurprising that no wetland inventories were identified that have been updated.

8 Standardising of inventory approaches

This section outlines the broad types of wetland inventory that have been included in this review, followed by notes on some relevant findings from the analysis of the African material which have bearing on wetland inventory approaches. Standardisation of inventory approaches must be developed in accordance with the objectives of those organisations carrying out wetland inventory. The ‘who’, ‘how’ and ‘why’ must be examined before any attempts to standardise procedures are made. Finally, generic suggestions for the standardisation of wetland inventory approaches are outlined.

8.1 Types of wetland inventory

As stated by Scott (1993) in his review of wetland inventories and their role in the assessment of wetland loss, there are three main types of inventory:

- comprehensive national wetland inventories
- regional or global inventories of specific wetland types
- national or international inventories of wetlands of special conservation importance

This review of wetland inventory material in Africa included material in each of these categories, which were defined by Scott (1993) as follows:

comprehensive national wetland inventories:

these constitute an accurate account of the location and extent of all wetland resources: they usually included detailed mapping and may or may not include an evaluation. Such inventories are time consuming and costly, and require a precise wetland classification system. However they provide and ideal basis for a comprehensive assessment of wetland loss over time.

regional or global inventories of specific wetland types:

such inventories are usually too crude and contain too many gaps in coverage to provide a baseline assessment of wetland loss.

national or international inventories of wetlands of special conservation importance

these focus on specific sites or systems with high conservation values, rather than wetland types, and on the whole exclude wetland habitat that is too small, fragmented or degraded to merit special attention. The Ramsar Convention provides and agreed set of criteria for the identification of sites of international importance, and these have been, or are being used in the compilation of wetland inventories in most parts of the world. Inventories of this type can be carried out relatively quickly and cheaply, and are of considerable value in focusing conservation effort where it is most required. While far too superficial to be used to measure total wetland loss, they constitute a sound basis for the monitoring of rates of loss of key habitat, especially those in countries which are unable to conduct comprehensive wetland inventories in the foreseeable future.

To this list, a further group could be added:

landscape level mapping of land use and land cover

these focus on the landscape from an anthropogenic perspective, and provide information on land use and land cover. They usually utilise satellite remote sensing technologies in combination with topographic maps, and soil maps. The resolution is frequently low (100x100ha) and does not distinguish between many wetland types, (this can be due to limitations in the spectral capabilities of the sensor, or may be due to operator preference). Wetlands are usually lumped into very broad generic categories. These may be categories such as ‘open water’, ‘forested wetlands’, and ‘agriculturally improved wetlands’, or may simply be one very broad category ‘wetlands’. In such inventories wetland habitat is quantified in terms of approximate area, and the distribution mapped. There is potential for monitoring total national wetland loss or change if the spatial resolution of the satellite sensor is high, or if rates of loss or change are very high. Assessments of wetland quality do not feature in these landscape maps.

8.2 Wetland inventory approaches in Africa – results from the analysis of the dataset

8.2.1 Who is conducting wetland inventory and who is funding it?

Non-governmental organisations (NGOs) and governmental organisations (GOs) were each responsible for implementing 29% of studies in Africa. Private agencies or individuals

implemented a further 25%; academic institutions implemented 11% of studies and consultancies conducted 7%. Compare this with the figures in Western Europe where most studies were implemented by government agencies. Similarly, NGOs and GOs each funded 57% of studies (including some studies funded by both). This equal weighting of NGO and GO could mean that governments in Africa are beginning to establish national wetland programs, though it is not possible to say whether historically most studies were implemented by agencies other than governmental ones.

Study Implementation	
International NGO	18%
National NGO	11%
Sub National NGO	0%
Local NGO	0%
International GO	0%
National GO	29%
Sub National GO	0%
Local GO	0%
Private agency/individual	25%
Consultancy agency	7%
Academic institution	11%
Other body	0%
Unknown	11%
More than one agency or body	7%
Study funding	
International NGO	39%
National NGO	18%
Sub National NGO	0%
Local NGO	0%
International GO	18%
National GO	39%
Sub National GO	0%
Local GO	0%
Private agency/individual	0%
Consultancy agency	0%
Academic institution	4%
Other body	0%
Unknown	18%
More than one agency or body	32%

8.2.2 Why is wetland inventory being carried out?

Considering the wide variety of organisations and individuals (NGOs, GOs, universities, consultants etc) undertaking wetland inventories in Africa, there is likely to be a variety of purposes. This study examined the objectives of wetland inventory activities. The objectives were stated in 61% of studies. The most common objectives (including those explicitly stated and surmised) were general biodiversity related (46%), for baseline inventory purposes

(50%), to examine wetland services (e.g. as bird habitat) (25%), public education (18%), land use planning (18%), international site designation (14%) and academic research (14%).

Note that most studies had several objectives. In the Africa region, only 27 out of the 54* countries are contracting parties to the Ramsar Convention (Source of Ramsar site Information: Ramsar Database, date of data extraction 17/8/98). It is therefore not so surprising that the objectives of wetland inventory activities were rarely international designation, and were most frequently for baseline inventory purposes.

Of the three complete regions examined for this review, Africa has the fewest number of Ramsar sites. There are only 74 Ramsar sites distributed through 54* countries (an average of 1.3 sites per country) (Source of Ramsar site Information: Ramsar Database, date of data extraction 17/8/98), which is much lower than the average for Western Europe (which is 21.3 Ramsar sites per country) and much lower than Eastern Europe (which has an average of 6.7 Ramsar sites per country). However, many of the African Ramsar sites are extremely large.

[*Note: the value "54" above represents a correction effected after publication of the 2nd ed. GRoWI CD-ROM]

Statement of objectives	
Objectives explicitly stated	61%
Objectives not explicitly stated	21%
Unknown	18%
Main objectives of study	
General biodiversity	46%
Biodiversity research	0%
Baseline biodiversity	0%
Repeat survey/surveillance	0%
Management tool for biodiversity	0%
Biodiversity monitoring	0%
Wetland products	0%
Geographical	0%
International designation	14%
Baseline inventory	50%
Academic research	14%
Land use planning	18%
Wetland services	25%
Public education	18%
Other research	0%
Other	43%

8.2.3 How are wetland inventory studies conducted?

Some 64% of studies examined for the Africa dataset were reviews and collations. Of the remainder, 32% undertook ground surveys and 14% utilised remote sensing techniques which were largely dependent on aerial photography (none of those examined, somewhat surprisingly, utilised satellite imagery).

However, it must be noted that there are studies that have utilised satellite imagery in Africa, (notably some studies undertaken in Zimbabwe and Zambia and carried out by the Food and Agriculture Organisation), though these were at the sub-national level and were not incorporated

in this review. Of those studies that did conduct ground surveys, 4% of these were total or near comprehensive in their coverage, and 18% undertook ground surveys which were partial in their coverage. For 11% of studies it was not known (either not stated, or not translated) how they were conducted.

Data collection methodology	
Collation or review	64%
Ground survey	32%
Remote sensing	14%
Questionnaire survey	0%
More than one methodology	21%
Unknown methodology	14%
Extent of ground survey	
Total	4%
Partial	18%
Type of remote sensing	
Satellite imagery	0%
Aerial photography	14%
Videography	0%
Radar imagery	0%
Lidar imagery	0%
Map product	4%
Unknown	0%

8.2.4 What definitions and classifications are used?

There are many definitions of wetlands, as others have noted (e.g. Davies & Claridge 1993, Dugan 1990). Dugan (1990) stated that over 50 separate wetland definitions were (even then) currently in use. Differing wetland definitions and classification schemes were used in different studies in Africa, and these definitions were generally not stated, making it difficult to assess the degree of completeness of cover (and thereby the estimates of wetland extent).

For example, the term ‘coastal wetlands’ can mean strictly saline and brackish habitats, or to mean wetlands in the coastal zone, (which often for practical purposes means coastal lowlands and incorporates wetlands which experience no tidal inundation). Sorensen (1997) provides six different and commonly used definitions for the term ‘coastal area’ which demonstrate the enormous difference between various meanings. Great improvements in the efficiency and accuracy of wetland evaluation could be achieved if common but imprecise terms were more precisely defined.

A definition of wetlands was provided in only 32% of studies, and only 50% of studies used the Ramsar definition of wetlands (though it was unknown for 43% of studies, so the true value may be much higher). The Ramsar classification system for wetland type was used in 21% of studies; it was unknown for 36% of studies and not applicable for some 29% of studies (these were usually reviews or collations of material). The use of the Ramsar classification system and definition of wetlands was much less than that in either eastern or western Europe (Stevenson & Frazier 1999a,b). This means that the information fields recorded and the approach used have generally not been standardised. This of course is

probably directly due to the fact that few African countries are contracting parties to the Ramsar Convention.

8.3 Generic suggestions for the standardisation of inventory approaches

1. Mechanisms to develop indices and scorecards of wetland value/benefits and site quality (status) should be developed to enable easy communication of the trends to be made to the decision-makers and the public.
2. The presentation of data in wetland inventories should become more accessible by inclusion of summaries and the avoidance of poorly organised bulky text descriptions in favour of tabulated results.
3. The scope of data coverage in wetland inventory activities should attempt to incorporate the information fields used in Ramsar Information sheets. This would aid management of trans-boundary wetlands and would facilitate regional and international wetland assessments which can be utilised in African (and global) policy and planning initiative.
4. Every effort should be made to cover all wetland types, particularly those types which are currently under-represented in wetland inventories. This includes artificial wetlands, dune slacks, wet mesotrophic grasslands, coral reef, dambos, ephemeral wetlands, seagrass beds, maerl beds, and wetlands of less than 50 ha in size. An attempt to systematically collect information on the current extent of different wetland types in different countries in the region should be carried out as a priority.
5. A program should be established to monitor changes in the areal extent of widespread rare and threatened wetland types once a baseline of the original or current extent is determined.
6. Standardised methodologies should be developed and linked to the objectives of wetland inventory studies, such that for any given objective, standard information fields should be gathered using standard methodologies.
7. A standardised (generic) database format (and software) should be developed for storage and extraction of local, national, and international wetland information that can be applied throughout the African region.
8. More effort should be made to integrate wildlife surveys (especially waterfowl) and wetland surveys to avoid duplication of effort and to increase the wider applicability of information.
9. Regional and national inventories should be made available in digital form as CD-ROMS or downloadable files from the World Wide Web to enhance access to the information and to encourage greater levels of feedback on changes at the sites.
10. A review should be undertaken on the applicability of land-use and land cover mapping information for the monitoring of changes in wetland extent in the region.

9 Priority areas for wetland inventory

9.1 Status of national level wetland inventory information in African countries

Although it was possible to generate estimates of the national wetland resource in all but a few African countries, much of the data was noted to be of poor quality and likely to be currently out of date. The majority of wetland area estimates examined by this report (though by no means all) were approximations based on often-dated aerial photography, soil and vegetation maps, and limited reconnaissance studies. The resulting best estimates must also be viewed with caution since accurate results cannot be generated from inaccurate data.

Countries that have experienced or are currently in civil conflict are notably among those with the greatest scarcity of data. In many of these cases, the only information identified in this review was that provided by Hughes and Hughes (1992), who made it clear that their estimates were very approximate and probably underestimates. These countries include Angola, Central African Republic, Chad, Ethiopia, Eritrea, Liberia, Libya, Mauritania, Niger, Rwanda and Western Sahara. Other countries which appear to have a paucity of information, most probably due to capacity problems, are Benin, Burkina Faso Burundi, Cape Verde, Sao Tome & Principe, Lesotho, Comoros, Mauritius, Mali, Equatorial Guinea, Somalia, Sudan, Swaziland and Togo.

Countries which have a low to intermediate level of wetland inventory information include Cameroon, Democratic Republic of Congo, Republic of Congo, Côte d'Ivoire, Djibouti, Ghana, Guinea Bissau, Guinea, Madagascar, Malawi, Morocco, Nigeria, Senegal and Sierra Leone (see table 9.1).

A number of countries have marginally more information, and can be regarded as having an intermediate level of wetland inventory information, though the scope and coverage greatly varies. In these cases, there are generally *significant* gaps in either information about specific wetland types or in national coverage; examples include Algeria, Ghana, Uganda, Malawi, Zimbabwe, Zambia, Tanzania, Kenya, Botswana, and Gabon (see table 9.1). Countries which have information largely focusing on internationally and nationally important wetlands include the Gambia, South Africa and Ghana.

Many specific types of wetlands are frequently ignored in wetland inventory activities in Africa. Wetlands of less than 10 ha in size were frequently underestimated in countries such as South Africa, Zimbabwe and Zambia. Endorheic pans and seasonal wetlands (particularly those which develop on a less than annual basis) are similarly underestimated. Hughes and Hughes (1992) note that the area of wetlands (especially water bodies) can be difficult to assess since the size can vary seasonally, annually and intra-annually. Artificial wetlands are also frequently ignored in wetland inventories, except in a few cases where they are of importance to waterbirds. These gaps should receive attention in future wetlands inventory activities in the region.

It should be noted that additional materials for Africa have been identified since the analysis stage of this review, and it is likely that these will reveal new information. Our findings must therefore be viewed as preliminary.

The majority of wetland area estimates examined by this report were approximations, (often based on dated aerial photography, soil and vegetation maps, and limited field studies). The resulting best estimates must therefore be viewed with caution since accurate results cannot be generated from such approximate data.

Out of the 55 countries in the African region examined in this review, only two of these can be said to have quasi-adequate inventory data on wetlands, and these are South Africa and Tunisia. However, several countries have plans to update their wetland inventory information, including Namibia, Uganda (to be confirmed), South Africa and Kenya. In Kenya, wetland inventory courses and waterbird identification and counting techniques courses have been conducted (and more are planned for 1999) in preparation for a planned national wetland inventory which will be coordinated by the Kenyan Wildlife Service and the National Environment Secretariat (Ministry of Environment). They are currently preparing a national wetlands database utilising the methodologies incorporated by the MedWet Initiative.

Table 9.1 Status of national wetland inventory information in African countries based on the GRoWI-Africa dataset [1]

Little or no national wetland inventory information	Some, but inadequate national wetland inventory information	Adequate information available, but requires updating and more detailed surveys
Angola	Algeria	South Africa
Benin	Botswana	Tunisia
Burkina Faso	Cameroon	
Burundi	Republic of Congo	
Cape Verde	Democratic Republic of Congo	
Central African Republic	Côte d'Ivoire	
Chad	Djibouti	
Comoros	Egypt [2]	
Equatorial Guinea	Gabon	
Ethiopia [3]	Gambia	
Eritrea	Ghana	
Lesotho	Guinea	
Liberia	Guinea-Bissau	
Libya	Kenya [4]	
Mali	Madagascar	
Mauritania	Malawi	
Mauritius	Morocco	
Niger	Mozambique	
Rwanda	Namibia [5]	
Sao Tome & Principe	Nigeria	
Somalia	Senegal	
Sudan	Sierra Leone	
Swaziland	Tanzania	
Togo	Uganda [6]	
Western Sahara	Zambia	
	Zimbabwe	

1 Note: these are preliminary assessments only

2 It has emerged that considerably more information on Egyptian wetland may exist than was included in the preliminary analysis of the GRoWI dataset, however, it has proved to be very difficult to obtain this information.

3 There are plans for the development of a wetlands program in Ethiopia, and this may ultimately lead to national wetlands inventory work. No further information is currently available.

4 The Kenyan Wildlife Service have been working on a Wetland Conservation and Training Programme, in preparation for a planned national wetland inventory program (1999–2002) to be undertaken by the KWS and the National Environment Secretariat (Ministry of Environment).

5 A national wetland database is being established by the Ministry of Environment and Tourism, Namibia. It currently contains a GIS and Namibian wetlands bibliography, information on Ramsar Sites, and shadow Ramsar sites, as well as rudimentary information on other wetlands, totalling approximately 3000 records. A working version should be available for the Ramsar Contracting Parties meeting planned for Costa Rica in May 1999.

6 It is known that Uganda has undertaken a preliminary national wetland inventory, however, obtaining the relevant information has proved difficult. The current status of wetland inventory work in Uganda is uncertain.

9.2 Relevance to previous studies

Taylor et al (1995) produced a review of wetland inventories in southern Africa, which outlined the main wetland inventory activities in the region and provided estimates of the national wetlands resources in 10 countries. Table 9.2 (below) compares the wetland area values reported by Taylor et al (1995), and the values estimated by the current study. The values produced by the GRoWI review are comparable with those given by Taylor et al (1995) with a few exceptions, notably Botswana, South Africa and Namibia.

The estimate of the national wetland resource in Botswana was estimated to be lower than that given by Taylor et al (1995), despite the fact that both studies drew heavily on Hughes and Hughes (1992). Moyo (1993) formed the basis of our best estimates for Botswana, but the figures provided by Moyo were based on Hughes and Hughes (1992). Perhaps this serves to demonstrate that the extraction of values from bulky textual sources is problematic, and is open to subject bias and error. In this case, Moyo (1993), Taylor et al (1995) and this study examined the same source of wetland information and derived different values.

The value provided by this study for South Africa is almost double that given by Taylor et al (1995). Although this may seem to be a significant increase, the study by Cowan (1997) on which the best estimates were based, is very comprehensive and comprises the most recent and detailed review of wetland inventory information in South Africa, and is likely to be accurate. The estimate for Namibia is also higher than that given by Taylor et al (1995) even though Taylor et al (1995) uses the same source materials as were utilised in this study. These were Simmons et al (1991), Hughes and Hughes (1992) and data from the Ministry of Wildlife and Tourism (personal communication).

Table 9.2 Comparison of wetland resource estimates in Southern Africa

Country	National wetland resource (ha): This study	National wetland resource (ha): Taylor et al 1995
Angola	470,000–510,000	475,000
Botswana	2,247,655	2,831,000
Lesotho	20,000 [1]	20,000
Malawi	2,248,150	1,500,000–2,891,000 [2]
Mozambique	2,563,185	2,412,200
Namibia	1,336,193– 1,371,043	1,180,700
South Africa	754,540 [3]	460,000
Swaziland	10,000 [4]	10,000
Zambia *	12,187,228	11,329,720 [5]
Zimbabwe *	1,683,180	1,280,000

1. The values in this study are based on those given by Taylor et al (1995) since no other estimates were identified.

2. Two estimates of wetland cover are given: 15.9% of land area (based on Agnew 1973) and 24.4% of land area (based on Hughes & Hughes 1992).

3. The estimate of wetland cover is based on work by Cowan (1997), and is the most recent and comprehensive work on South African wetlands to date.

4. The values in this study are based on those given by Taylor et al (1995) since no other estimates were identified.

5. Approximately 5% of land area, stated as 3,800,000 ha, is estimated to be large wetlands and shallow water bodies, and a further 10% of land area is dambo wetlands (approx. 7,529,720 ha) which combined, result in a total of 11,329,720 ha

* Taylor et al (1995) values were used in the best estimate process (subjective comparison of data), for these countries, although the values provided by Taylor et al (1995) were not themselves used as the best estimates.

10 Priority processes

This section provides brief recommendations pertaining to wetlands inventory activities as a whole. It proved beyond the scope of this study to recommend particular field survey methods, or to provide instructions for wetland inventory activities. Taylor et al (1995) covers the relative merits and disadvantages of wetland inventory methods used in southern Africa and these are equally applicable throughout the Africa region.

Similarly, it would not be appropriate to enter the debate on traditional field survey techniques versus remote sensing techniques (again these are discussed admirably by Taylor et al (1995), and Grainger (1993), from analogous forestry studies). However, the process of extracting and analysing data from the sources examined in this review, has revealed common problems that could be easily avoided. For example, if wetland inventory data were presented in a particular fashion, and if certain specific data were routinely recorded for the benefit of the reader (such as date of survey, objectives, and wetland definition and coverage).

10.1 Establishing inventories

10.1.1 Preparatory activities

- A thorough review of previous studies and surveys undertaken should be conducted prior to any wetland inventory activity, to delineate gaps and to benefit from lessons learned or mistakes made. This should also include less obvious sources such as academic material and conference material, as well as conventional wetland inventories.

- Adequate time and resources should be allocated (by funding bodies and implementing agencies) to review, and obtain existing wetland inventory material for any given region or country. As stated by Taylor et al (1995), it requires time and effort to establish the existence of sources of information already available, and often there is repetition of previous survey work because adequate efforts to assess the existing information base have not been undertaken. This project has identified several cases where source material has quoted wetland area estimates taken from studies that had been comprehensively updated by more recent studies, and therefore their estimates were out of date, and had been supplanted by more recent and accurate data.

10.1.2 Background and setting to wetland inventory activities

- Information such as the history, development and rationale of wetland inventories is crucial for understanding the context of these studies and should be described briefly within reports. Information detailing contact persons and addresses is very helpful to successive workers, as are plans for future activities. If the surveys are part of a longer-term study, this should also be stated.

10.1.3 Objectives

- The objectives of wetland inventories should be identified prior to the commencement of wetland inventory activities (particularly those involving fieldwork). The objectives of

wetland inventory activities should play a key role in choice of the most suitable wetland inventory methodology to be used in any given particular inventory program.

- Wetland inventory activities should aim to make provision for regular updating of wetland information, and where appropriate should make provision for monitoring changes in extent, distribution and loss of wetlands.
- The objectives should be clearly stated in wetland inventory reporting and published material.
- Those coordinating wetland inventory activities should specifically aim to widely disseminate wetland inventory material, and should aim to permit ready access to wetland inventory information. This objective should feature in all future wetland inventory activities.

10.2 Updating or extending inventories

10.2.1 Wetland coverage

- Certain wetland types were commonly excluded from wetland assessments and these included artificial wetlands (e.g. fish ponds, rice paddy, reservoirs and dams) and natural wetlands including dune slacks, humid sands, dambos, wet mesotrophic grasslands, seagrass beds, maerl beds, coral reefs, glacial and alpine wetlands. More attention should be paid to these and similarly overlooked wetland types in future inventory studies.

10.2.2 Wetland definitions and classification of wetlands

- Clear distinction should be made between the description of ‘marine wetlands’ and ‘coastal wetlands’, and ‘inland wetlands’. Extracting information on even broad wetland categories is difficult when authors use the terms that are ill defined or easily confused. For example, some authors use the term ‘coastal wetlands’ to mean strictly saline and brackish habitats and others use it to mean wetlands in the coastal zone (which often for practical purposes mean coastal lowlands and incorporates wetlands which experience no tidal inundation).
- A definition of wetlands should be always be given, and it should be expressly stated whether habitats such as floodplains, and open water bodies have been included in the definition and whether they have been included in a wetland survey.
- Where wetland classification systems are used, these should be stated and adequately referenced.

10.3 Inventory content

10.3.1 Minimum information fields

- Wetland area estimates and identification of whether wetland area estimates are minimal, maximal or average values (stating number of years and which years the average value is based on).
- The geographical coordinates and general location of wetlands should always be included, so that discrepancies involving the names of wetlands can be identified by location. (For countries which are newly independent, it is very difficult identifying wetlands which have been renamed, and adequate geo-referencing may reduce this difficulty.)

10.3.2 Recommended information fields

- Objectives of study.
- Dates of field work (including season) and collation should always be included, as well as the known dates of any compiled information.
- Description of methodologies used in fieldwork.
- Resolution capabilities of remotely sensed data.
- Definition of wetland used.
- Classification scheme used (e.g. Ramsar, Cowardin, Corine etc).
- Inclusions/exclusions in coverage (e.g. excluding wetlands of less than 100 ha, or excluding open water bodies etc).
- A *summary* of the coverage and characteristics of the wetland resource including tabulations where possible.
- Contact points for data custodians or publishers and their institutional details.
- Contact details of persons undertaking fieldwork should always be provided.
- Full referencing of primary source material should always be provided in reviews/collations.
- Ramsar Information Sheet data fields.

10.4 Wetland values and benefits

- Information on wetland values and benefits should be included in wetland inventories. As a minimum this should constitute a textual description of benefits, but preferably should indicate the economic values for wetland goods and services.
- A structure to aid the assessment of wetland benefits and values using simple means and local knowledge of wetland sites should be developed for use in conjunction with wetland inventories. This could take the form of a key or questionnaire which could be spilt into sections under the headings of fisheries, water supply, tourism, education, hydrological functions etc, and the assessor answer general questions under the appropriate headings. Or it could take the form of a table which should be completed, with sections containing questions such as ‘approximately how many artisanal fishermen use this site? Is this seasonal? Approximately what is their daily/weekly catch? Or this could take the form of a matrix, which the assessor simply adds tick marks where a particular good or service is important. More effort should be put into developing simple ways of calculating the approximate total economic value of a wetland site in a standardised manner.
- The findings of wetland inventories that complete preliminary assessments of the values and benefits of a particular wetland site, should be widely disseminated in order to demonstrate the values and benefits to policy makers and management authorities.

10.5 Temporal scale/updating programs

- It could be argued that low resolution comprehensive national surveys should be undertaken as a priority to at least identify wetland locations for more detailed study later. However, in terms of resource conservation, repetition of detailed surveys at sites thought to be at risk should also be a priority undertaking.

- Wetland inventories must be regularly reviewed and updated otherwise data are likely to be lost, become out of date and become of historical interest only.

10.6 Presentation of data

- A summary of the coverage and characteristics of the wetland resource, should preferably be included in all wetland inventory reference material. It is exceedingly difficult to construct a useful overview of an inventory reference by extracting values and statistics from reams of text entries.
- Local naming conventions of wetlands or locations are often ignored, and authors may use their own 'version' of a local name for a particular wetland. There are obviously difficulties in translation, but more efforts should be made to ensure that the local and English (and French etc as appropriate) version names are included in inventory material if it is intended for use beyond the local area. A guide to the pronunciation of local names may also be useful, (particularly where these names have not previously been recorded, and are perhaps only known by local names) although this may not be practicable for directory type inventories.
- Key quantitative wetland inventory information should preferably not be presented in block text format (where data such as coverage and loss estimates lay hidden in sentences, perhaps with imprecise wording leading to an ambiguous interpretation). This would aid the input of existing and future inventory information into database format.
- Maps of habitats and atlases should also present summary area and type by area information. Many maps examined did not contain a scale and/or other fundamental spatial reference information such as geographic co-ordinates. It is very difficult to manually extract useful inventory or management information out of most of the maps examined for potential inclusion in the African dataset.

10.7 Handling and storage of wetland inventory information

- Every effort should be made to store both the paper and electronic versions of wetland inventory information with both those coordinating or conducting wetland inventory, and also with international organisations such as the Ramsar Bureau and Wetlands International or a central clearing house (if one is developed).
- Electronic forms should preferably be stored in some format which is readily translatable into either word processing packages or databases.
- A standardised (generic) database format (and software) should be developed for storage and extraction of local, national, and international wetland information that can be applied throughout the African region.

10.8 Availability and dissemination of inventories

- Much material is currently available in draft format, remains unpublished or has a limited distribution. Considerably more effort should be devoted to ensuring that existing draft reports are finalised, and resources permitting, published, preferably with some or all of the information made available on the World Wide Web.
- Those undertaking to produce national bibliographic databases, should also be aware that the usefulness of such information is severely limited if there is no provision for supplying the references to those who need them. Funding should be made available to

ensure that national bibliographic databases don't simply supply a list of references, but can also provide copies of the material upon request. The existence of such databases should also be more widely advertised.

- More emphasis should be directed toward publishing electronic format material (e.g. World Wide Web presentations) as well as any paper versions of reports.
- A central clearinghouse or structured information retrieval system for wetland inventory material should be put in place. It should be noted that identifying and obtaining wetland inventory material for a particular country may be largely dependent on a network of contacts and may chiefly rely on key individuals and/or organisations to supply or provide access to data. It is likely that these persons and organisations receive repeated requests for information and a positive result often depends on the goodwill and resources of these key individuals and organisations. The current situation is that a person or agency seeking information must first identify the 'key players', which in itself is often a time consuming process. The retrieval of information can occasionally be restricted due to deliberate actions on the part of some individuals who see a request for information as an opportunity to offer their services for substantial fee rates, and who it appears deliberately withhold information to increase their bargaining power.

11 Specific recommendations

The reader should also consult sections 8 and 10 for more detailed recommendations:

- National wetland policies should be established, and national wetland inventory programs commenced as a priority. These should be organised in such a way as to enable easy updating and review.
- Existing preliminary wetland inventories should be expanded upon to form national wetland inventories.
- Existing wetland inventory material should be updated in order to assess changes (especially loss or gain). Where it does not already exist, a baseline should be established for measuring future changes in wetland area, function and values, and more baseline wetland inventory activities should be undertaken.
- Dambos, and other specific wetlands types which are currently under represented (e.g. wetlands of less than 10 ha in size, artificial wetlands, endorheic and temporary wetlands) should be included in any inventory activities.
- More efforts to integrate wetland surveys with bird surveys should be made, and basic wetland characteristics and function should be recorded. Much bird count related material was identified in this study, but often these contained little useful wetland information. For countries known to have few wetland assessment or management initiatives, it is especially important that ornithologists also examine and provide basic wetland inventory information. The African Waterfowl Census database, which is maintained by WI-AEME, has enormous potential to assist with this particularly in certain West African and Central African countries.
- The results of wetland inventory activities should be adequately advertised and published, particularly on the World Wide Web, or at least disseminated to a wide audience (including libraries).
- Bibliographic databases set up to list information sources of wetlands within a given country should also provide details of where to obtain reference material, and provide

contact details. Preferably, a system should be established where persons requiring particular information could contact one agency for this information. A clearing house or document supply centre would be very useful, and would improve information accessibility in Africa enormously. Information availability should not depend on the goodwill and resources of those in possession of particular material, unless they were the original authors.

- Where only specific wetland types are included in a survey this should be stated, and a definition of this type provided. Inclusions and exclusions should be clearly identified.
- Geographic co-ordinates, general location and names (local and other) should be included in wetland inventories, and where possible also a map. This was frequently lacking for much of the material examined for Africa.
- Tomàs Vives (1993) cited in Costa et al (1996) stated that all wetlands, independent of their importance, should be covered by a national wetlands inventory. This is particularly true in African countries, since the identification and designation of internationally important wetlands under the Ramsar Convention is either in its early stages, or has not yet begun, (only 27 out of 55 countries in this region are contracting parties to the Ramsar Convention).
- Wetland inventories should aim to closely follow the format given in the Ramsar Information Sheets (RIS). This should serve to aid management of trans-boundary wetlands and should facilitate regional and international wetland assessments that can be utilised in African (and global) policy and planning initiatives.

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Our sincerest apologies to any person or institute we may have inadvertently omitted from this list.

Annex 2 Best Estimates of Wetland Coverage

(see section 3.3 for a list of countries omitted from this section)

	Country name (& Code)		Area (ha) Wetland				
	ALGERIA ALG		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	0	4,900	0	4,900	Date of extraction 14 August 1998; area of man-made type is very small, could not be separated from inland
2	Hughes and Hughes 1992	001	121,380- 134380	585,500	8,000	714,880-727,880	figures for inland are mainly chotts (salt pans). Coastal values vary due to annual variation in winter rainfall
3	Britton & Crivelli 1993	505	3,000	390,800	3,300	397,100	Values are likely to be reliable, but scope and definition of marine/coastal wetlands is obviously different to Hughes and Hughes 1992.
4	Chown & Linsley 1994	024	0	127,701	200	127,901	Inventory was of northern wetlands only. Inland lakes (saline and fresh water) =25,941 ha & wetlands (muddy basins, flats & marshes) =101,760 ha. Areas have been calculated from dimensions & therefore approximate.
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			121,380- 134380	585,500	8,000	714,880-727,880	

Notes/comments on best estimate

Hughes and Hughes estimates are fairly comprehensive including vegetated and open water bodies, and floodplains, hence the higher values. Likely to be roughly accurate.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	ANGOLA			***Area (ha) Wetland***			
	AGO		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Spalding, Blasco and Field 1997	501	60,700	0	0	60,700	Estimate of mangrove only. Data based on Hughes and Hughes 1992
2	Hughes and Hughes 1992	001	70,000	397,500	0	467,500	I) It is noted by the author that the value for coastal wetlands is probably much less than this figure. ii) Values for inland are an underestimate: author provides descriptions of many wetland complexes, but the figures are not available.
3	Wenban Smith 1993	002	110,000	0	0	110,000	Estimate of mangrove only. Based on WCMC 1992 data
4	GLCC www database	none	0	55,000	0	55,000	Date of extraction 22 July. Value is sum of Lake Gove 30,000 and Lake Calueque 25,000 ha only
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			70,000-110,000	400,000	?	470,000-510,000	

Notes/comments on best estimate

Hughes and Hughes state that coastal value is likely to be an underestimate and yet Wenban Smith provides a higher value for mangrove alone, therefore a range for coastal is provided. For inland, the only estimate available is Hughes and Hughes

Date of best estimate 21-Aug-98

	Country name (& Code)						
	BENIN		Area (ha) Wetland				
	BEN		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Spalding, Blasco and Field 1997	501	1,700	0	0	1,700	Estimate of mangrove only. Data based on Hughes and Hughes 1992
2	Hughes and Hughes 1992	001	175,790	129,000	0	304,790	Estimate for 'marine /coastal' includes seasonally & high tide innundated lakes in the coastal plain. Estimate for inland is mainly floodplain & permanent swamp .
3	European Commission 1992	101	3,000	0	0	3,000	Estimate of mangrove only. Estimate by Baglo-M pers comm. Note: loss has been severe since the 1970's, though to be due to changes in water regime and human pressure.
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			175,790	129,000	0	304,790	

Notes/comments on best estimate

Hughes and Hughes estimates are fairly comprehensive including vegetated and open water bodies, and floodplains, hence the higher values. Likely to be roughly accurate.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	BOTSWANA			***Area (ha) Wetland***			
	BWA		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	0	6,864,000	0	6,864,000	Date of data extraction: August 14th 1998.
2	Hughes and Hughes 1992	001	0	2,243,250	4,405	2,247,655	Estimates should be fairly reliable
3	Moyo 1993	013	0 0 *1,800,500*	1,600,000 200,500 *1,800,500*	2,148 0 *2,148*	1,802,648	i) Inland value = Okavango delta (probably inc dry areas) . ii) Manmade values = mainly dams. Author describes other sites inc mining pools and sewage ponds, but areal values not provided. Values for pans,lakes,marshes & rivers Total wetlands value.Arguably Moyo's inventory could be regarded as comprehensive in its coverage.
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			none	2,243,250	4,405	2,247,655	

Notes/comments on best estimate

Hughes and Hughes 1992 are in fair agreement with Moyo 1993. Note that the Ramsar site area is much bigger than the area of the Okavango wetland itself

Date of best estimate 21-Aug-98

	Country name (& Code)						
	BURKINA FASO		Area (ha) Wetland				
	BFA		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	0	299,200	0	299,200	Date of extraction 14 August 1998
2	Hughes and Hughes 1992	001	0	364,958	?	364,958	Ts = floodplain (total = approx 173100 ha) and floodplain wetlands (total = approx 29650 ha). Several reservoirs & other artificial impoundments are described but unquantified in terms of area. Lakes values are approximate.
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			0	364,958	?	364,958	

Notes/comments on best estimate

Hughes and Hughes is the only estimate located that lists wetlands specifically. The Ramsar database also includes non-wetland area.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	BURUNDI			***Area (ha) Wetland***			
	BDI		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Hughes and Hughes 1992	001	0	499,000	0	499,000	Ts = riverine swamps and floodplains combined. Value for lakes covers only Burundi's proportion where these lakes are transboundary (eg Tanganyika & Tshohoha south)
2	0		0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			none	499,000	unknown	499,000	

Notes/comments on best estimate

Hughes and Hughes is the only estimate for inland, presumably there are manmade wetlands, but these remain undescribed.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	CAMEROON		Area (ha) Wetland				
	CMR		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Spalding and Field 1997	501	249,400	0	0	249,400	estimate of mangrove only
2	Wenban Smith 1993	002	306,000	0	0	306,000	estimate of mangrove only
3	European Commission 1992	101	272,500	0	0	272,500	estimate of mangrove only. Values based on FAO 1980
4	Hughes and Hughes 1992	001	300,000	2,255,613	0	2,555,613	i. Estimate for marine/coastal is area of 'tidal forest'. ii Estimate for inland lakes inc. CMR's proportion of lakes Barombi Mbo, Chad, Fianga, & Ossa. iii Type inland 'Ts' in this case is fldplain wetlands.
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	
10							
Best estimates (ha)			300,000	2,255,613	?	2,555,613	

Notes/comments on best estimate

Most sources of information broadly agree on the extent of coastal wetlands, with Hughes and Hughes incorporating all tidal forest not just mangrove. Hughes and Hughes provide the only estimate for inland wetlands

Date of best estimate 21-Aug-98

	Country name (& Code)						
	CENTRAL AFRICAN REPUBLIC			***Area (ha) Wetland***			
	CAF		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Hughes & Hughes 1992	001	-	3,150,000	?	3,150,000	Hughes & Hughes provide a short description of the wetlands, and an approximate coverage value, however it appears that little hard data exists for CAF, and it is uncertain whether the value given here is comprehensive.
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)				3,150,000		3,150,000	

Notes/comments on best estimate

No other estimates other than Hughes & Hughes were identified and therefore must be used for the best estimate

Date of best estimate 28-Aug-98

	Country name (& Code)						
	CHAD			***Area (ha) Wetland***			
	TCD		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	-	195,000	0	195,000	Date of extraction 14 August 1998
2	Hughes and Hughes 1992	001	-	12,983,390	1,666,000	14,649,390	A comprehensive estimate with the exception of a few small lakes. A large floodplain near N'Djamena described by Hughes & Hughes as '440 km long & between 25-125 km wide' has been estimated to have a mean area of 3,000,000ha to improve the assessment
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			-	12,983,390	1,666,000	14,649,390	

Notes/comments on best estimate

No other estimate other than Hughes and Hughes 1992 has been identified.

The Ramsar database does not cover wetlands exclusively, and does not cover the entire country

Date of best estimate 21-Aug-98

	Country name (& Code)						
	DEMOCRATIC REPUBLIC OF CONGO			***Area (ha) Wetland***			
	ZAR		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	66,000	800,000	0	866,000	Date of extraction 14 August 1998
2	Spalding, Blasco and Field 1997	501	37,400	0	0	37,400	Estimate of mangrove only. Data based on NASA/GSFC & Uni Maryland data from NOAA/AVHRR (1km pixel) 1988 satellite images.
3	Hughes and Hughes 1992	001	0	14,551,095	0	14,551,095	No estimate for coastal wetlands is given, otherwise the estimate is comprehensive
4	Ministere de l'environnement 1995	020	[66,000]	[2,573,000]	0	[2,639,000)	These are the areas of national parks containing wetlands, the actual wetlands areas are not specified.
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			37,400	14,551,095	?	14,588,495	

Notes/comments on best estimate

Spalding et al 1997 provide the only estimate for coastal wetlands. Both estimates are combined to derive a total best estimate
Hughes and Hughes provide the only estimate for inland wetlands
The Ramsar database areas cover more than just wetland area.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	CONGO (Republic of)			***Area (ha) Wetland***			
	COG		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	0	438,960	0	438,960	Extraction date 14 August 1998; no wetland types available yet
2	Spalding, Blasco and Field 1997	501	18,800	0	0	18,800	Estimate of mangrove only. Data based on Hughes and Hughes 1992
3	Hughes and Hughes 1992	001	740,000	11,686,500	0	12,426,500	Only COG's proportionof wetlands are included in transboundary wetlands. ii many mosaic wetland types, so difficult to classify type by area.
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			740,000	11,686,500	?	12,426,500	

Notes/comments on best estimate

Hughes & Hughes 1992 estimate for marine includes mangrove, mud flats & water bodies, & possibly estuarine area. Inland area includes floodplain wetlands. No areas for manmade were identified.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	COTE D'IVORIE		***Area (ha) Wetland***				
	CIV		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	19,400	0	0	19,400	Date of extraction 14 August 1998; although inland types are listed, the sites are completely coastal/marine
2	Spalding, Blasco and Field 1997	501	64,400	0	0	64,400	Estimate of mangrove only. Data based on Hughes and Hughes 1992 with some additonal info added by authors.
3	Hughes and Hughes 1992	001	173,470	?	105,000-172,000	278,470-345,470	ii Detailed values are given for coastal lagoons (separated into swamp and open water values) total here = swamp & o/w. ii Range of values given for inland impoundments. iii) Values for inland riverine wetlands not provided, but thought to be significant
4	Nicole et al 1994	014	292,330	0	0	292,330	Values cover coastal wetlands only (includes 9000 ha open water lagoon/estuary)
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			292,330	?	105,000-172,000	397,330-464,330	

Notes/comments on best estimate

Nicole et al 1994 was comprehensive in its coverage of coastal wetlands. Inland values are not known, Manmade values are only provided by Hughes and Hughes 1992.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	DJIBOUTI			***Area (ha) Wetland***			
	DJI		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Spalding, Blasco and Field 1997	501	1,000	0	0	1,000	i) Estimate of mangrove only. ii) Data based on 1985 Landsat MSS satellite imagery and Forgiarini & Cesar 1987. Vegetation et resources pastorales 1: 250,000
2	Hughes & Hughes 1992	001	0	37,200	0	37,200	R = salt pans/flats and Q= saline lakes which vary in size according to season. Tidal wetlands inc mangrove & saltmarsh are also described, but unquantified
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			1,000	37,200	?	38,200	

Notes/comments on best estimate

Spalding and Blasco present estimates of mangrove , whereas Hughes and Hughes provides no coastal wetland values, and vice versa for inland wetlands. No data for manmade wetlands were identified

Date of best estimate 21-Aug-98

	Country name (& Code)						
	EGYPT			***Area (ha) Wetland***			
	EGY		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	105,700	?	?	105,700	Date of data extraction August 14th 1998.
2	Spalding, Blasco and Field 1997	2998	86,100	0	0	86,100	i) Estimate of mangrove only. ii) Data based on a regional skletch map by Sheppard (1992) ie unreliable data.
3	Hughes and Hughes 1992	001	2,634,550	711,200	0	3,345,750	Does not include Suez canal, lower nile irrigated area, and new valley oases, otherwise fairly comprehensive
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			2,634,550	711,200	0	3,345,750	

Notes/comments on best estimate

Hughes and Hughes is the only comprehensive assessment identified to date.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	EQUATORIAL GUINEA			***Area (ha) Wetland***			
	GNQ		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Spalding, Blasco and Field 1997	501	27,700	0	0	27,700	Estimate of mangrove only. Data based on Hughes and Hughes 1992
2	Hughes and Hughes 1992	001	27,700	0	0	27,700	Very little information is provided. No mention of freshwater wetlands or manmade wetlands
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			27700	?	?	27700	

Notes/comments on best estimate

No other information is available, and therefore Hughes and Hughes aproximate estimate must be used

Date of best estimate 21-Aug-98

	Country name (& Code)						
	ERITREA		Area (ha) Wetland				
	ERI		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	Reference code					
1	Spalding, Blasco and Field 1997	2998	58,100	0	0	58,100	i) Estimate of mangrove only. ii) Data based on personal communications with Chris Hillman and Liz Ross.
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			58,100	0	0	58,100	

Notes/comments on best estimate

Due to boundary changes when Eritrea declared independance from Ethiopia in 1993, information appears to be scant.
However, information on wetlands is available but is difficult to extract from wetlands which fall within the existing Ethiopia boundaries.
This task requires more time than the GRoWR project could provide, and should be examined more thoroughly in the future.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	GABON		Area (ha) Wetland				
	GAB		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	648,000	432,000	0	1,080,000	Date of data extraction August 14th 1998
2	Schepers et al 1993	003	257,500	0	0	257,500	Values are derived from fieldwk in 1992 and map studies. Other values also given-total length= 615km sandy beach habitat: 49km coastal brackish lagoons. Data not given for area of estuarine waters (which is significant area)
3	GLCC www database	none	0	20,000	0	20,000	Values for Lake Onangue only. Data for other lakes not provided.Unsure of wetland type.
4	Spalding, Blasco and Field 1997	501	175,900	0	0	175,900	Estimate for mangrove only.Estimate based on 1:150000 1993 &1994 vegetation maps by Fontes & Fromard, with minor corrections by Blasco.
5	Wenban Smith 1993	002	250,000	0	0	250,000	Estimate of mangrove only. Based on WCMC 1992 data
6	Hughes and Hughes 1992	001	350,000	3,968,875	0	4,318,875	Estimate for marine = "tidal forest in broadest sense" ie not just mangrove. Estimate for inland includes rivers, streams, floodplain,riverine swamp & 'swampy rain forest"
7	European Commission 1992	010	250,000	0	0	250,000	Estimate of mangrove only. Basis of estimate or reference not provided.
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			175,900-257,500	3,968,875	?	4,144,775-4,226,375	

Notes/comments

Schepers and Marteijn 1993 estimates based on field wrk & map wrk.
Spalding, Blasco and Field 1997 estimates based on map work also
Schepers and Marteijn 1993 also provide estimates of total length of sandy beach habitat= 615km and coastal brackish lagoons =49km .
Hughes and Hughes 1992 is the nearest estimate we have for inland that is comprehensive.

Date of best estimate 22-Jul-98

	Country name (& Code)						
	GAMBIA		Area (ha) Wetland				
	GMB		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	10,000	10,000	-	20,000	Date of data extraction August 14 1998
2	European Commission 1992	010	60,000-67,000	0	0	60,000-67,000	Based on Saenger at al 1983.Values for Gambian River basin.
3	De Bie 1990	009	?	?	?	13,627	Total Value incs: Gambia Saloum, Gambia River Natl Pk: Kiun West, Jakhaly Swamp, but NOT mangrove areas, or Bund Road Lagoon, Banjul. Therefore value is likely to be underestimate.
4	Spalding, Blasco and Field 1997	501	74,700	0	0	74,700	Estimate for mangrove only
5	Hughes and Hughes 1992	001	45,000	?	?	45,000	Very little information is provided.
6	Dep Parks & Wildlife Mgt 1997	015	0	0	0	181,308	Total value given encompasses "uncultivated and cultivated swamps" covering 81,276 ha & 33,344 ha respectively, & mangrove 66,688ha. Figures are based on FAO data 1994 (which in turn are based on 1983 aerial photos)
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			74,700	106,608	?	181,308	

Notes/comments

Based on the assumption that Spalding, Blasco & Field 1997 have accurate estimates for mangrove, and that the Department Parks and Wildlife Management have a good overall estimate of wetlands (probably not including open water bodies), then inland wetlands probably account for approximately 106,000 ha

Date of best estimate 21-Aug-98

	Country name (& Code)						
	GHANA		Area (ha) Wetland				
	GHA		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	171,150	6,534	726	178,410	Date of data extraction 14th August 1998
2	European Commission 1992	101	0	0	0	0	No figures given due "to lack of recent data". Good ecological description provided though.
3	0	0	0	0	0	0	0
4	Spalding, Blasco and Field 1997	501	21,400	0	0	21,400	Estimate for mangrove only. Based on undated UNEP-GRID project AVHRR (1 km pixel) satellite imagery
5	Hughes and Hughes 1992	001	117,800	460,050	895,225	1,473,075	Fairly comprehensive.
6	Piersma & Ntiamoa-Baidu 1995	117	64,500	0	0	64,500	Open water areaof Songor lagoon and Keta lagoon, (Volta estuary) only.
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			117,800	460,050	895,225	1,473,075	

Notes/comments

Hughes and Hughes 1992 provides the nearest to a comprehensive assessment available

Date of best estimate 21-Aug-98

	Country name (& Code)						
	GUINEA		Area (ha) Wetland				
	GIN		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	225,011	-	-	225,011	Date of data extraction August 14th
2	Spalding, Blasco and Field 1997	501	308,300	0	0	308,300	Estimate of mangrove only. Data derived from 1979-80 aerial photos, updated using Landsat MSS 1984-1985-1986 imagery.
3	Hughes and Hughes 1992	001	200,500	121,500	?	322,000	Areas for several small lakes and manmade were not available. Status of some coastal mangroves is also uncertain, and one area that did exist in 1980 is now thought to have been reduced significantly (and not included here)
4	Wenban Smith 1993	002	223,000	0	0	223,000	Estimate of mangrove only. Based on WCMC 1992 data
5	European Commission 1992	010	260,000	0	0	260,000	No basis of estimate or reference given.
6	Altenburg and van der Kamp 1991	011	290,500-310,000	0	31,200	321,700 - 341,200	Values for manmade are rice fields in freshwater swamp areas. Also approx 4,200km of tidal creek in mangrove areas (260,000ha). All values are based on late 1980's data updated by arial reconnaissance & ground survey between 1988-1990
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			250,000	121,500	?	371,500	

Notes/comments on best estimate

A conservative estimate for coastal wetlands is given due to likely conversion to rice culture.
Hughes and Hughes provides the only estimate for inland wetlands.

Date of best estimate 21-Aug-98

	Country name (& Code) GUINEA-BISSAU GNB		Area (ha) Wetland				
			MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	39,098	-	-	39,098	Date of data extraction August 14th 1998
2	Spalding, Blasco and Field 1997	501	364,900	0	0	364,900	Estimate of mangrove only. Data taken from a generalised map hand drawn by Scott Jones in 1990 based on IGN (1981) map data, but updated to show forest loss.
3	Hughes and Hughes 1992	118	200,000	?	0	200,000	Very little information is provided and the estimate for coastal wetlands approximate since losses are known to have occurred due to clearance, but no figures are available
4	Wenban Smith 1993	002	236,000	0	0	236,000	Estimate of mangrove only. Based on WCMC 1992 data
5	European Commission 1992	10	?	0	0	0	Values not available due to transboundary description of wetlands (not per country estimates)
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			200,000-364,900	?	?	200,000-364,900	

Notes/comments on best estimate

All values are approximate and so at best only a range of values can be suggested.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	KENYA		Area (ha) Wetland				
	KEN		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	Reference code					
1	Ramsar database	none	-	48,800	-	48,800	Date of data extraction August 14 1998
2	Spalding, Blasco and Field 1997	501	96,100	0	0	96,100	Estimate of mangrove only. Based on Desol (1995) " a vegetation map of kenya".
3	Crafter, Juguna & Howard 1992	008	53,000	87,000	?	140,000	i) Marine value for mangrove only. ii) inland value may also included manmade wetlands,but not stipulated by Crafter et al 1992. Types of wetland included in inland estimate not given.
4	Hughes and Hughes 1992	001	69,000-90,000	2,641,690	0	2,710,690-2,731,690	TS =cumulative total for 'grassy' & 'swampy flooplains', & Tp =cumulative total for 'swamps' and 'pans'. Several wetlands, flplains & swmps are described but not quantified & values for l are for Tana River only, ie values may be an underestimate.
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			96,100	2,641,690	?	2,737,790	

Notes/comments on best estimate

Spalding et al 1997 & Hughes and Hughes 1992 have good agreement on mangrove area.
Hughes and Hughes inland wetlands include floodplains & this is probably why the estimate is so much larger than that of Crafter et al 1992
No estimates for manmade wetlands have been identified.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	LESOTHO		Area (ha) Wetland				
	LSO		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Hughes and Hughes 1992	001	-	?	?	?	No area values are provided however it is noted that "there are extensive bogs & spongelands in the high rainfall areas of the mountains…montane bogs cover tens of thousands of hectares, mostly above 2300m..small swamps & fldplains occur in the lowlands"
2	Taylor, Howard & Begg	025	-	?	?	20,000	This is given as 'approximate wetland area'.
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			?	?	?	20,000	

Notes/comments on best estimate

The total value from Taylor Howard and Begg has been used for the best estimate, though it must be noted that this value is approximate

Date of best estimate 21-Aug-98

	Country name (& Code)						
	Liberia		Area (ha) Wetland				
	LBR		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Gatter 1988	004	33,140	0	9,000	42,140	Other values: length (km) of A:streams in i) coastal areas=140 ii) hill areas=505: B rivers in i)coastal areas=185 ii) hill areas=435 iii) mtn areas=80: C creeks in i) coastal areas 380 ii) hill areas=1335 highland areas=600. sml coastal lagoons=429
2	Gatter 1988(b)	006	33,140	0	0	33,140	article in german,but appears to be based totally on work from Gatter 1988 (ICPB)
3	GLCC www database	none	12,000	0	0	12,000	value for Lake Piso only
4	Spalding, Blasco and Field 1997	501	42,700	0	0	42,700	Estimate for mangrove only. Value based on undated UNEP-GRID project AVHRR (1 km pixel) satellite imagery
5	Hughes & Hughes 1992	001	39,750	0	0	39,750	Many wetland sites are described but remain unquantified and therefore the values must be an underestimate
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			42,700	?	9,000	51,700	

Notes/comments on best estimate

Although Spalding et al 1997 could be an over estimate due to the large pixel size of the satellite imagery, there should be reasonable accuracy. Gatter 1988 provides the only estimate of manmade wetlands.

Date of best estimate 22-Jul-98

	Country name (& Code)						
	LIBYA		***Area (ha) Wetland***				
	LBY		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Meininger, Wolf et al 1994	018	3,150	0	0	3,150	This source covers only coastal wetlands and only some of these. Several freshwater wetlands are noted, but no area values are provided. Information is slim.
2	0	0	0	0	0	0	
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			?	?	?	?	

Notes/comments on best estimate

A best estimate is not possible

Date of best estimate 21-Aug-98

	Country name (& Code)						
	MADAGASCAR		Area (ha) Wetland				
	MDG		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	Reference code					
1	Spalding, Blasco and Field 1997	501	340,300	0	0	340,300	Estimate of mangrove only. Data based on Faramala Miadana Harisoa (1996) data which is based mainly on 1972-79 Landsat satellite imagery.
2	Hughes and Hughes 1992	001	371,747	340,000	32,300	744,047	Estimates for f/w & b/w coastal lagoons are approximate. Total value is correct.
3	Wenban Smith 1993	002	326,000	0	0	326,000	Estimate of mangrove only. Based on WCMC 1992 data
4	European Commision 1992	010	327,000	0	0	327,000	Estimate of mangrove only. Based on Kiener 1966, though authors state " it is likely that present are of mangroves does not differ widely from Kiener 1966" NJS disagrees.
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10							
Best estimates (ha)			340,300-371,747	340,000	32,300	712,600-744,047	

Notes/comments on best estimate

All estimates for coastal wetlands are in approximate agreement, however, Spalding et al 1997 is likely to be accurate due to use of satellite imagert (albeit in 1972-70) and Hughes and Hughes provides a higher estimate and therefore a range has been sugggested for coastal wetlands.
Only Hughes and Hughes provide an estimate for inland and manmade wetlands and is therefore used as a best estimate.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	MALAWI		Area (ha) Wetland				
	MWI		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	0	224,800	0	224,800	Date of data extraction : August 14th 1998
2	Hughes & Hughes 1992	001	0	2,248,150	0	2,248,150	Value for Tp inland probably alos includes some seasonal/intermittent wetlands. There are several sites which are described but are unquantified.
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)				2,248,150		2,248,150	

Notes/comments on best estimate

Although Taylor, Howard and Begg 1995 also contained wetland area information, it was based on Hughes & Hughes, with mention of earlier (1980's) work which we have been unable to obtain for this review. It seems that there are additional wetland areas of dambos, (Taylor et al 1995), but there is discrepancy over the area of dambos. It should be noted that the Hughes & Hughes estimate which has been used for the best estimate is probably an underestimate

Date of best estimate 28-Aug-98

	Country name (& Code)						
	MALI		Area (ha) Wetland				
	MLI		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	-	162,000	-	162,000	Date of data extraction: August 1998
2	De Bie 1990	831	0	2,162,000	0	2,162,000	Estimate includes Lakes Oualado, Debo, & Horo, the Seri Plain and the inner delta of the Niger river
3	Hughes and Hughes 1992	001	0	3,560,400	69,000	3,629,400	TS = river floodplains.Many floodplains are mentioned but unquantified. R actually refers to wet /humid sands ('daias') (ie not really wetland type R).
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)				3,560,400	69,000	3,629,400	

Notes/comments on best estimate

The estimate by Hughes and Hughes includes floodplain wetlands which proabbaly accounts for the higher estimate that De Bie 1990.
Hughes and Hughes is the only estimate for manmade and therefore must be used as a best estimate

Date of best estimate 21-Aug-98

	Country name (& Code)						
	MAURITANIA		Area (ha) Wetland				
	MRT		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	1,180,800	7,800	0	1,188,600	Date of data extraction August 14th 1998
2	Spalding, Blasco and Field 1997	501	1,040	0	0	1,040	Estimate of mangrove only. Data based on Hughes and Hughes 1992
3	Hughes and Hughes 1992	001	63,000	568,388	37,500	668,888	The coastal estimate includes mud flats as well as mangrove. Several pans are descirbed but not included in the estimate of inland, since no area values were given.
4	De Bie 1990	009	?	?	?	1,196,000	Estimate included the Banc A'rguin, Senegal river delta system, Aftout es Sahel & several lakes. Value given does not include some sites for which coverage is unknown & therefore likely to be an underestimate.
5	Van Wetten et al 1990	021	0	83,895	0	83,895	This inventory gives detailed decsriptions of inland wetland sites in the south of Mauritania only.
6	Lamarche & Gowthorpe yr=?	022	?	?	?	?	This is not an inventory, and contains no area information, however, it does list 90 wetlands with a rating score of biodiversity and conservation importance. Useful for planning inventory activities.
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			?	?	?	668,888-1,196,000	

Notes/comments on best estimate

It is difficult to make a best etsimate since De Bie 1990 appears to be comprehensive, but provides a total estimate almost twice that given by Hughes and Hughes 1992. An approximate range estimate is suggested.

Date of best estimate 22-Jul-98

	Country name (& Code)						
	MOZAMBIQUE		Area (ha) Wetland				
	MOZ		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Hughes and Hughes 1992	001	260,530	1,950,785	266,500	2,477,815	Many lakes, floodplains, pans, lagoons & swamps are described without quantification, and therefore the values provided here must be an underestimate
2	Spalding, Blasco and Field 1997	501	345,900	0	0	345,900	Estimate of mangrove only. Based on Ministerio da Agricultura (1980) Mapa Florestal.
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			345,900	1,950,785	266,500	2,563,185	

Notes/comments on best estimate

It is not clear in all cases whether some of the swamps described in Hughes & Hughes in certain lowlands are f/w or brackish water, & may have been attributed to inland when they are in fact coastal. Many inland wetlands & lakes are not quantified which may redress this imbalance. Therefore the value for coastal wetlands given by Spalding is retained as the best estimate for marine. The Hughes & Hughes values for inland and manmade are used for best estimates of those types. The estimates must be regarded as approximate.

Date of best estimate 28-Aug-98

	Country name (& Code)						
	MOROCCO		***Area (ha) Wetland***				
	MAR		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	10,200	380	-	10,580	Date of data extraction August 14 1998
2	Hughes and Hughes 1992	001	33,200	27,880	?	61,080	25 artificial impoundements occur but are not quantified. Ts inland encompasses marshland and floodplain.
3	Britton & Crivelli 1993	505	29,300	43,800	7,500	80,600	Values are likely to be reliable
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			29,300-33,200	27,800-43,800	7,500	64,600-84,500	

Notes/comments on best estimate

Both Britton & Crivelli 1993 & Hughes & Hughes1992 give apparently reliable estimates. They are in close agreement for the coastal wetlands, but not for inland, and unusually the Hughes and Hughes estimate is lower than that of another.
There is no reason to assume that one is more accurate than the other and so a range for inland has been given.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	NAMIBIA			Area (ha) Wetland			
	NAM		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	29,600	600,000	-	629,600	Date of data extraction August 14 1998
2	Hughes and Hughes 1992	001	9,850	1,073,003	2,500	1,085,353	R inland = pans, & Tp =swamps. Several manmade sites and inland pans are described, but areas not quantified, therefore total value is an underestimate
3	Ministry Environment & Tourism database	016	?	?	?	0	A national wetland inventory is underway utilising aerial photos, ground survey and collation/review. No area values available at present.
4	Simmons , et al 1991	023	6,500-7,000	1,322,160-1,353,660	7,533	1,336,193-1,368,193	Data is taken from a wetlands workshop in which authors presented info on various wetland types. Overall it seems comprehensive though some area values were absent, eg karst wetlands,some river mouths & manmade.
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			6,500-9,850	1,322,160-1,353,660	7,533	1,336,193-1,371,043	

Notes/comments on best estimate

It is difficult to judge which is more accurate for coastal Hughes and Hughes 1992 or Simmons et al 1991, so a range of values has been chosen. Hughes and Hughes 1992 inland and manmade estimates are underetsimates and therefore the values given by Simmons et al 1991 have been chosen for inland and manmade best estimates

Date of best estimate 22-Jul-98

	Country name (& Code)						
	NIGER		Area (ha) Wetland				
	NER		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	-	220,000	0	220,000	Date of extraction August 14th 1998
2	Hughes and Hughes 1992	001	-	1,764,950	?	1,764,950	Values given are underestimates since many wetlands are described but no area values are given. Salt pans and irrigation waters are described but not quantified
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			-	1764950	?	1764950	

Notes/comments on best estimate

No other estimates were identified and therefore Hughes and Hughes is used for the best estimate.

Date of best estimate 14-Aug-98

	Country name (& Code)						
	NIGERIA		Area (ha) Wetland				
	NGA		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Spalding, Blasco and Field 1997	501	1,113,400	0	0	1,113,400	Estimate of mangrove only. Based on undated UNEP-GRID project AVHRR (1 km pixel) satellite imagery
2	Hughes and Hughes 1992	001	828,775	946,460	123,000		Total area of particular wetland types identified by Hughes & Hughes I,K, Sp Ts & O (type O=lake Chad)
			518,000	4,580,600	0		Total area of broad types including the Niger Delta, the Niger/Benue river system, the Komadugu Yobe, the Ngadda, Yederam and El Beid rivers, & the Cross river ie mostly swamp, floodplain & riverine forests.
			1,346,775	*5,527,060*	*123,000*	6,996,835	Total area of wetlands described in Hughes and Hughes 1992
3	Wenban Smith 1993	002	3,238,000	0	0	3,238,000	Estimate of mangrove only. Based on WCMC 1992 data
4	European Commission 1992	010	1,824,000	0	0	1,824,000	Estimate of mangrove only. Based on 1960's and 1970's data.
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
Best estimates (ha)			1,346,775 - 3,238,000	5,527,060	123,000	6,996,835 - 8,888,060	

Notes/comments on best estimate

Total area given by Hughes and Hughes for marine coastal all types is much less than that given by Wenban Smith for mangrove alone.
There is no obvious explanation for this. Therefore a range between the 2 values is suggested for marine and coastal wetlands
The only estimates for inland and manmade wetlands are those given by Hughes and Hughes and therefore these have been used for best estimates.

Date of best estimate 28-Aug-98

	Country name (& Code)						
	RWANDA			***Area (ha) Wetland***			
	RWA		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
2	Hughes and Hughes 1992	001	0	348,100	0	348,100	Values are approximate.
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)				348,100		348,100	

Notes/comments on best estimate

No other wetland area estimates other than Hughes and Hughes 1992 have been identified

Date of best estimate 22-Jul-98

	Country name (& Code)		Area (ha) Wetland				
	SENEGAL SEN		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	73,720	26,000	-	99,720	Date of data extraction August 14th 1998
2	Spalding, Blasco and Field 1997	501	183,000	0	0	183,000	Estimate of mangrove only. Data based on USGS (1985) with some modifications
3	Hughes and Hughes 1992	001	371,000	16,000	0		Areas for individual wetland types at sites where the areas are quantified
			137,000	647,000	-		Values given for each category (inland and marine/coastal) are very approximate since for areas such as the Senegal Delta it is difficult to quantify these areas as separate types.
			508,000	*663,000*		1,171,000	Total area of wetlands
4	Wenban Smith 1993	002	169,000	0	0	169,000	Estimate of mangrove only. Based on WCMC (1992) data
5	European Commission 1992	010	?	?	?	?	Values not available due to transboundary description of wetlands (not per country estimates)
6	De Bie 1990	009	?	?	?	277,266	Total value incl: the Natl Pks Casamance, Djoudj, Iles dela Madeleine, Langue de Barbarie: the Biosphere Reserve Saloum: the reserves Point de Kalissaye, Popenguine & Guembeul: Gurer Lake: the delta & upper Senegal river: not coastal lakes.Underestimate.
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			508,000	663,000	?	1,171,000	

Notes/comments on best estimate

Spalding et al 1997 and Wenban Smith 1993 cover only mangroves. De Bie 1990 also includes coastal islands within the estimate & therefore Hughes and Hughes provides the most comprehensive estimate currently available

Date of best estimate 21 Aug 1998

	Country name (& Code)		Area (ha) Wetland				
	SIERRA LEONE SEL		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Spalding, Blasco and Field 1997	501	169,500	0	0	169,500	Estimate of mangrove only. Based on undated UNEP-GRID project AVHRR (1 km pixel) satellite imagery
2	Hughes and Hughes 1992	001	170,600	108,820	0	279,420	No area values are provided for the riverine wetlands and several lakes which are described and therefore the value will be a underestimate
3	Wenban Smith 1993	002	250,000	0	0	250,000	Estimate of mangrove only. Based on WCMC 1992 data
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
Best estimates (ha)			170,600	108,820	?	279,420	

Notes/comments on best estimate

Spalding et al 1997 and Hughes and Hughes 1992 are in agreement for the coastal wetlands, Wenban Smith is based on coarse data, and so Hughes and Hughes has been chosen as the best estimate for coastal wetlands.
Hughes and Hughes provide the only estimate for inland wetlands

Date of best estimate 21-Aug-98

	Country name (& Code)						
	SOMALIA			***Area (ha) Wetland***			
	SOM		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Spalding, Blasco and Field 1997	501	91,000	0	0	91,000	i) Estimate of mangrove only. ii) Data based on Hughes and Hughes (1992) with additions by Blasco. Noted as unreliable estimate
2	Hughes and Hughes 1992	001	?	600,000	?	600,000	Many tidal marsh & mangrove sites are listed but unquantified. Karst lakes & sinkholes & small endorheic depressions are listed as common & numerous, but also unquantified. Therefore total value is underestimate.
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			91,000	600,000		691,000	

Notes/comments on best estimate

Since only one estimate per wetland type has been identified, we can only use those figures.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	SOUTH AFRICA		***Area (ha) Wetland***				
	ZAF		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	223,068	266,930	-	489,998	Date of data extraction August 14th 1998
2	Spalding, Blasco and Field 1997	501	33,500	0	0	33,500	Estimate of mangrove only. Based on Hughes and Hughes 1992 but noted as approximate estimate
3	Cowan 1997	019	276,367	276,911	201,262	754,540	very comprehensive review of wetland coverage in South Africa
4	Hughes and Hughes 1992	001	0	0	0	0	(to be calculated yet)
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			276,367	276,911	201,262	754,540	

Notes/comments on best estimate

Cowan 1997 conducted a very thorough review of wetlands in S Africa,and his data has been used for the best estimate,
though Cowan has stated that many smaller wetlands are not included in this estimate. Therefore, value given here must be an underestimate

Date of best estimate 21-Aug-98

	Country name (& Code)						
	SUDAN		Area (ha) Wetland				
	SDN		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	Reference code					
2	Spalding, Blasco and Field 1997	501	93,700	0	0	93,700	i) Estimate of mangrove only. ii) Data based on a regional sketch map in Sheppard (1992). Data noted as likely to be unreliable.
3	Hughes and Hughes 1992	001	0	4,155,900	311,500	4,467,400	Estimate for inland & manmade wetlands appears to be comprehensive, though there is no estimate for coastal wetlands, & there are a number of floodplains & water bodies which are described but not quantified.
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			93,700	4,155,900	311,500	4,561,100	

Notes/comments on best estimate

Spalding et al 1997 provide the only estimate of coastal wetlands & Hughes and Hughes provide the only estimate of inland and manmade wetlands.

Date of best estimate 22-Jul-98

	Country name (& Code)						
	SWAZILAND			***Area (ha) Wetland***			
	SWZ		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Hughes and Hughes 1992	001	0	?	?	0	there are no wetlands of major importance however the existence of small areas of swamp, peat bog, pools & reed filled dam ponds and dam lakes are mentioned but unquantified.
2	Taylor, Howard & Begg	025	-	0	?	10,000	Value is approximate since there are no reliable data for Swaziland.
3	0	0	0	?	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			-	?	?	10000	

Notes/comments on best estimate

The best estimate is still likely to be very approximate

Date of best estimate 21-Aug-98

	Country name (& Code)						
	TANZANIA			***Area (ha) Wetland***			
	TZA		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Spalding, Blasco and Field 1997	501	245,600	0	0	245,600	Estimate of mangrove only. Data based on summary map of a more detailed mangrove forest inventory supported by NORAD, based on aerial photos taken in 1988/89
2	Kamukala& Crafter 1993	005	200,000	2,700,000	85,000	2,985,000	re inland: wetland types uncertain, but quoted as "permanent or seasonal f/w swamps & seasonal fldplains"= 2.7 million ha. In adddition shoreline figures are given = coast length 1000km, Lake Nyasa 305km. Lake Tanganyika 650km : lake Victoria 1420km.
3	Wenban Smith 1993	002	134,000	0	0	134,000	Estimate of mangrove only. Based on WCMC 1992 data
4	Hughes and Hughes 1992	001	196,000	8,389,286	83,300	8,668,586	Ts =cumulative floodplain area Tp = swamp/wetland/papyrus. O=lake open water area. Some sites are described but not quantified, ie underestimate. Some areas have been calculated from average length x breadth dimensions.
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
Best estimates (ha)			200,000-245,600	8,389,286	85,000	8,674,286-8,719,886	

Notes/comments on best estimate

Hughes and Hughes 1992 coastal wetlands estimate is an underestimate and therefore Kamukala &Crafter's estimate (which is similar) for coastal wetlands is possibly also an underestimate. A range of values for coastal has been suggested using the Spalding et al 1997 estimate as a maximum value

Hughes and Hughes 1992 inland wetlands estimate is comprehensive and includes floodplains.

Kamukala &Crafter's 1993 estimate and Hughes and Hughes 1992 estimate for manmade is very closely matched.

The higher value has been chosen since the source material for Kamukala &Crafter is more recent

Date of best estimate 28-Aug-98

	Country name (& Code)						
	TOGO		Area (ha) Wetland				
	TGO		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	0	194,400	0	194,400	Date of data extraction August 14th 1998
2	Hughes and Hughes 1992	001	44,400	73,200	?	117,600	Estimates are approximate and mid range values where annual differences occur
3	0	0	0	?	0		0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			44,400	73,200	?	117,600	

Notes/comments on best estimate

Hughes and Hughes 1992 provides the only estimate of wetland area in Togo found to date

Date of best estimate 21-Aug-98

	Country name (& Code) TUNISIA TUN		Area (ha) Wetland				
			MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	-	12,600	-	12,600	0
2	Britton & Crivelli 1993	505	96,100	819,000	0	915,100	Values are likely to be reliable
3	Chown & Linsley 1994	024	29,960	830,830	0	860,790	Includes important bird areas only.
4	Hughes et al 1994	007	113,084	1,182,915-1,207,915	20,787	1,316,786-1341,786	Inventory is comprehensive & (probably) includes all wetlands, however, many area values have been calculated from dimensions, some areas are not given, some are average values (wet/dry values), & some data is from 1928.
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			113,084	1,182,915-1,207,915	20,786.50	1,316,786-1341,786	

Notes/comments on best estimate

Hughes et al 1994 was very comprehensive and is the most recent study, however some data is rather dated, but is probably the best estimate of wetland area currently available.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	UGANDA			***Area (ha) Wetland***			
	UGA		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	-	15,000	-	15,000	Date of data extraction August 14th 1998
2	Scott, Omoding et al 1993	012	0 0	3,590,770 860,933 - 963,323 *4,451,703-4,554,093*	0 0	4,451,703-4,554,093	There are 45 wetland sites listed., 21 of these have unknown areas. The 45 sites are sites proposed for inventory, and therefore this is not a comprehensive listing of wetlands in UGA. Value provided here is open water lakes. Value provided here is for fldplain wetlands and swamps (not lakes). Total value in summary sheet =open water + wetland area.
3	Hughes and Hughes 1992	001	0	4,874,575	0	4,874,575	O=open water lakes Tp = lacustrine swamps Ts mainly riverine swamps & floodplains
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
Best estimates (ha)			none	4,451,703-4,874,575	?	4,451,703-4,874,575	

Notes/comments on best estimate

The lower value suggested by Scott et al and the higher value suggested by Hughes and Hughes 1992 have been combined to produce a range of values for a best estimate of inland wetlands.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	WESTERN SAHARA ESH		Area (ha) Wetland				
			MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Hughes and Hughes 1992	001	?	72,430	0	72,430	Figures are approximate. Tidal marshes are said to occur, but there is no quantification.
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			?	72430	0	72430	

Notes/comments on best estimate

Hughes and Hughes is the only source of information on wetlands in the Western Sahara as yet identified.

Date of best estimate 21-Aug-98

	Country name (& Code)						
	ZAMBIA		Area (ha) Wetland				
	ZMB		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Ramsar database	none	0	333,000	0	333,000	Date of data extraction August 14th 1998
2	Hughes amd Hughes 1992	001	-	4,133,028	454,200	4,587,228	Area for manmade includes Lake Kariba (241,200ha). Type Ts inland includes 986,500ha of wetland described as 'swamps & floodplains' & 1,674,100ha of floodplain. Value for P inland is actually a combination of floodplain lakes & floodplain
3	Taylor, Howard, & Begg 1995	025	-	?	?	11,400,000	The total estimate is not sub divided into types, but described as follows: large wetlands including 'shallow open waters' =3,800,000ha. A further 7,600,000ha are dambos
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)				11,733,028	454,200	12,187,228	

Notes/comments on best estimate

It is difficult to make a best estimate where estimates differ so widely. However, it appears that Taylor et al 1995 & Hughes & Hughes are in broad agreement for large wetland areas (3,800,000ha & 4,587,228ha respectively) However Taylor et al provide a further figure of 7,600,000ha for thousands of dambos, suggested by Chidumayo 1992 which increases the area substantially. So, the figures for dambos have been added to the Hughes & Hughes inland estimate to derive a comprehensive value for wetlands. Dambos do not appear to have been assessed by Hughes and Hughes so the best estimate should not be an overestimate/duplication

Date of best estimate 28-Aug-98

	Country name (& Code)						
	ZIMBABWE			***Area (ha) Wetland***			
	ZWE		MARINE/COASTAL	INLAND	MANMADE	TOTAL	NOTES
	Reference author	**Reference code**					
1	Hughes and Hughes 1992	118	-	58,500	324,680	383,180	Ts inland = mid Zambezi valley & Mana pools only. R inland = seasonal pans (though noted as difficult to estimate). 6 manmade = Zim's proportion of Lake Kariba.
2	Taylor, Howard & Begg 1995	025	-	?	?	1,280,000	Value given is total areaof wetlands
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
Best estimates (ha)			none	1,358,500	324,680	1,683,180	

Notes/comments on best estimate

Taylor, Howard & Begg's figures are based on a survey by Whitlow 1985 who suggested that there are approximately 1.3 m ha of dambos in Zimbabwe, Hughes & Hughes suggest that there are some 58,500 ha of inland natural wetlands (not including dambos) therefore the best estimate for inland is comprised of a combination of these two estimates. It is uncertain whether manmade wetlands were included in Whitlow's assessment of wetlands, but it is assumed they are not. Therefore the manmade estimate from Hughes & Hughes is also incorporated in the total best estimate

Date of best estimate 21-Aug-98

Annex 3 Definitions and Abbreviations

Ramsar Region The Ramsar Bureau has adopted a system whereby countries are assigned to one of the following administrative and reporting regions: Africa, Asia, Eastern Europe, Neotropics, North America, Oceania and Western Europe.

Regional Scale A scale which encompasses all or the vast majority of countries within one Ramsar region.

Supra-regional Scale A scale which is greater than the Regional scale which normally encompasses several countries within any *two or more* Ramsar regions but not covering each and every country within those Ramsar regions.

Sub-regional Scale A scale which is greater than the national scale which normally encompasses several countries within any *one* Ramsar region but not covering each and every country within that Ramsar region.

Wetland Inventory Assessment Sheet

This consists of a series of sheets designed to evaluate and summarise wetland inventory material. These are completed for each and every inventory source which contains useful coverage and attribute data. The details from these sheets are then entered into the GRoWI database. Wetland Inventory Assessment Sheets are not completed for sources which are deemed to be of little use for inventory purposes.

Wetland According to the Ramsar Convention, 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. In addition, the Ramsar Convention (Article 2.1) provides that wetlands: 'may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands'.

Wetland Inventory For the purposes of this project the definition of 'wetland inventory material' is necessarily broad, and encompasses standard wetland inventories carried out specifically for this purpose, but also includes material, which does not constitute a wetland inventory *per se* (e.g. Hughes et al 1994, A Preliminary Inventory of Tunisian Wetlands). Relevant NGO material, GO material, conference proceedings, workshop material and

	academic/research material were also considered as wetland inventory material.
eriss	Environmental Research Institute of the Supervising Scientist
GO	Governmental organisation
NGO	Non-governmental organisation
WI-A	Wetlands International–Americas
WI-AEME	Wetlands International–Africa, Europe, Middle East
WI-AP	Wetlands International–Asia Pacific
WIAS	see *Wetland Inventory Assessment Sheet*
GRoWI	Global Review of Wetland Resources and Priorities for Wetland Inventory