

Ramsar
Handbooks
4th edition

Handbook 13

Inventory, assessment, and monitoring





About the Convention on Wetlands

The Convention on Wetlands (Ramsar, Iran, 1971) is an intergovernmental treaty whose mission is “the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world”. As of October 2010, 160 nations have joined the Convention as Contracting Parties, and more than 1900 wetlands around the world, covering over 186 million hectares, have been designated for inclusion in the Ramsar List of Wetlands of International Importance.

What are wetlands?

As defined by the Convention, wetlands include a wide variety of habitats such as marshes, peatlands, floodplains, rivers and lakes, and coastal areas such as saltmarshes, mangroves, and seagrass beds, but also coral reefs and other marine areas no deeper than six metres at low tide, as well as human-made wetlands such as waste-water treatment ponds and reservoirs.

About this series of handbooks

This series has been prepared by the Secretariat of the Convention following the 7th, 8th, 9th, and 10th meetings of the Conference of the Contracting Parties (COP7, COP8, COP9 and COP10) held, respectively, in San José, Costa Rica, in May 1999, Valencia, Spain, in November 2002, Kampala, Uganda, in November 2005, and Changwon, Republic of Korea, October–November 2008. The guidelines on various matters adopted by the Parties at those and earlier COPs have been prepared as a series of handbooks to assist those with an interest in, or directly involved with, implementation of the Convention at the international, regional, national, subnational or local levels. Each handbook brings together, subject by subject, the various relevant guidances adopted by Parties, supplemented by additional material from COP information papers, case studies and other relevant publications so as to illustrate key aspects of the guidelines. The handbooks are available in the three working languages of the Convention (English, French, and Spanish).

The table on the inside back cover lists the full scope of the subjects covered by this handbook series at present. Additional handbooks will be prepared to include any further guidance adopted by future meetings of the Conference of the Contracting Parties. The Ramsar Convention promotes an integrated package of actions to ensure the conservation and wise use of wetlands. In recognition of these integrated approaches, the reader will find that within each handbook there are numerous cross-references to others in the series.

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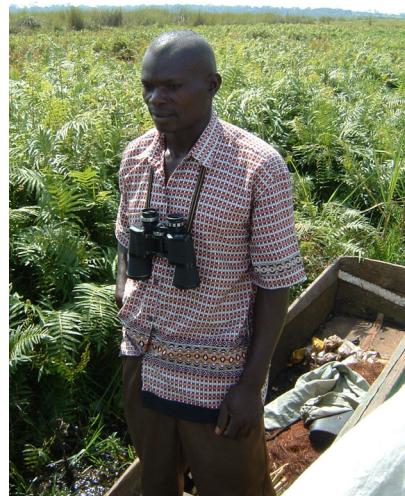
Cover photo: Monitoring and data collection, Glaciar Vinciguerra Ramsar Site, Argentina. 2002 (Photo: Rodolfo Iturraspe)

Ramsar handbooks for the wise use of wetlands
4th edition, 2010

Handbook 13

Inventory, assessment, and monitoring

An Integrated
Framework for wetland
inventory, assessment,
and monitoring

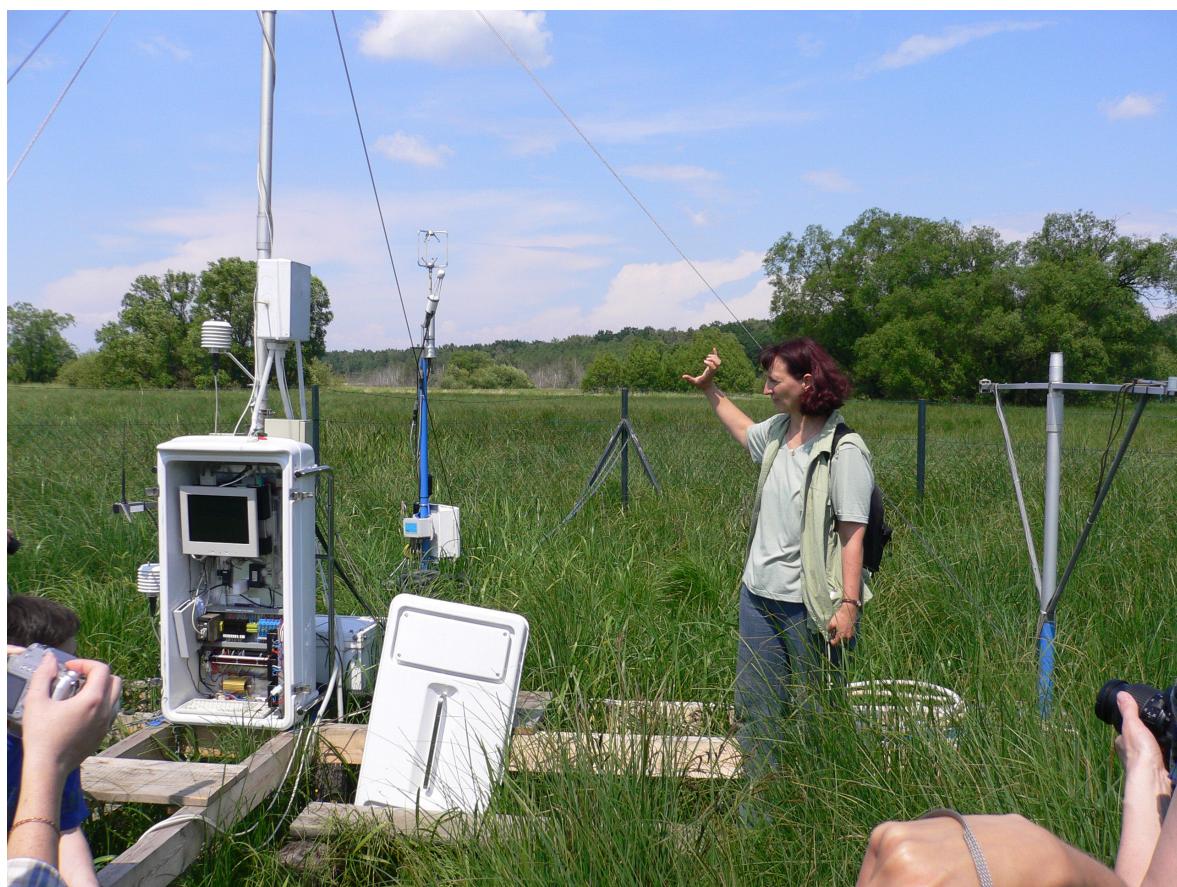


This 4th edition of the Ramsar Handbooks replaces the series published in 2007. It includes relevant guidance adopted by several meetings of the Conference of the Parties, in particular COP7 (1999), COP8 (2002), COP9 (2005), and COP10 (2008), as well as selected background documents presented at these COPs.

Acknowledgements

The Integrated Framework for Wetland Inventory, Assessment and Monitoring (IF-WIAM) was prepared by the Scientific & Technical Review Panel's Working Group on inventory and assessment, led by Max Finlayson, with significant contributions from Dave Pritchard. The IF-WIAM was developed from a COP8 (2002) Information Paper on the topic (included as the Appendix to this Handbook), which was prepared by Max Finlayson with the assistance of Dolf de Groot, Habiba Gitay, Dave Pritchard and the Ramsar Secretariat. The Secretariat is particularly grateful to Max Finlayson for his efforts in developing the IF-WIAM guidance and to Dave Pritchard for developing the later frameworks for describing wetland ecological character and for detecting, reporting and responding to change in ecological character.

All Resolutions of the Ramsar COPs are available from the Convention's Web site at www.ramsar.org/resolutions. Background documents referred to in these handbooks are available at www.ramsar.org/cop7-docs, www.ramsar.org/cop8-docs, www.ramsar.org/cop9-docs, and www.ramsar.org/cop10-docs.



Hana Cizkova explaining hydrological monitoring equipment, Trebon Ramsar Site, Czech Republic, 2007.
Photo: Tobias Salathé / Ramsar

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Getting the most out of this Handbook

The Handbooks in general

The purpose of the Ramsar Handbooks is to organize guidance material from relevant decisions adopted by the Contracting Parties over the years, according to subject themes. This helps practitioners to implement the internationally-agreed best practice in a way that is convenient to handle and more naturally matches their own everyday working environment.

The intended readership includes national and local staff of the government departments, ministries and agencies that act as Administrative Authorities for the Ramsar Convention in each country. Equally important users in many cases are managers of individual wetland areas, as some aspects of the guidance relate specifically to site management.

The Ramsar guidance has been adopted by member governments as a whole, and increasingly it addresses itself to the crucial roles of other sectors beyond the “environment” or “water” sectors. It is thus very important that these Handbooks should be used by **all** whose actions may benefit from or impact upon the wise use of wetlands.

A vital first step in each country therefore is to ensure adequate **dissemination** of these Handbooks to all who need or can benefit from them. Copies are freely available in PDF format from the Ramsar Secretariat in three languages on CD-ROM or by download from the Convention website (www.ramsar.org).

Other early steps would be, in each particular context, to **clarify** lines of responsibility and **actively check** how to align the terms used and approaches described with the reader’s own jurisdiction, operating circumstances, and organizational structures.

Much of the text can be used in a **proactive sense**, as a basis for framing policies, plans and activities, sometimes by simply importing relevant sections into national and local materials. It can also be used in a **reactive sense** as a source of help and ideas for responding to problems and opportunities, navigating subjects by the need of the user.

Cross-references, original sources, and further reading are liberally cited: the Handbooks will often not be the “last word”, but they provide a helpful “route-map” to further sources of information and support.

Strategic direction in the Ramsar Convention is provided by the Strategic Plan, the latest version of which was adopted by COP10 in 2008 for the period 2009-2015. All thematic implementation frameworks, including the Handbooks, sit within the context of the goals and strategies of this Plan and the priorities it highlights for the period covered.

In this fourth edition of the Handbooks, additions to and omissions from the text of the original guidelines, required by the results of COP8, COP9 and COP10, are shown in square brackets [...].

The Handbook series is updated after each meeting of the Conference of the Parties, and feedback on user experience is always appreciated in helping to refine each new edition.

This Handbook (Inventory, assessment, and monitoring)

Strategy 1.1 of the Strategic Plan 2009-2015, concerning wetland inventory and assessment, is to “describe, assess and monitor the extent and condition of all types of wetlands as defined by the Ramsar Convention and wetland resources at relevant scales, in order to inform and underpin implementation of the Convention, in particular in the application of its provisions concerning the wise use of all wetlands”.

The text in this Handbook is drawn mainly from Resolution IX.1 and its Annex E, and the substance of it thus reflects formal decisions adopted by the Conference of Contracting Parties. The Handbook also brings together other resource materials relevant to the issue; the views expressed in these additional materials do not necessarily reflect the views of the Ramsar Secretariat or the Contracting Parties, and such additional materials have not been endorsed by the Conference of the Contracting Parties.



Training in monitoring techniques, The Netherlands. Photo courtesy Sergey Dereliev.

Foreword

The suite of guidance documents on the scientific, technical and policy implementation of the Ramsar Convention adopted by its Contracting Parties over the past 20 years (and compiled in this 4th edition of the Ramsar Wise Use Handbooks) is ever increasing. During the 2003-2005 triennium, the Convention's Scientific & Technical Review Panel (STRP) recognized that a set of thematic frameworks would assist Parties to identify and use the guidance they need.

Such frameworks, prepared by the STRP and adopted by 9th meeting of the Conference of the Contracting Parties (COP9) in 2005 under Resolution IX.1, include the overarching *Conceptual Framework for the wise use of wetlands and the maintenance of their ecological character* (Handbook 1, 4th edition), a revised *Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance* (Handbook 17, 4th edition), *An Integrated Framework for the Ramsar Convention's water-related guidance* (Handbook 8, 4th edition), and *An Integrated Framework for wetland inventory, assessment and monitoring (IF-WIAM)* (this Handbook, 4th edition). COP10 (2008) added *A Framework for Ramsar data and information needs* (Handbook 14, 4th edition) and *A Framework for processes of detecting, reporting and responding to change in wetland ecological character* (included in Handbook 19, 4th edition). In addition, Handbook 15 (4th edition) now comprises *A Ramsar Framework for wetland inventory and ecological character description*.

Inventory, assessment and monitoring of wetlands are fundamental tools that provide the basis for many aspects of successful implementation of the Convention. The IF-WIAM focuses on the purposes of, and inter-relationships among, the different aspects and tools on wetland inventory assessment and monitoring available under the Convention's guidance documents. As well as summarizing each of these available guidance documents, the IF-WIAM outlines how and when each of them should be used; it also identifies some other key topics on which guidance is provided elsewhere or may be expected at a later date from the STRP.

Importantly, the IF-WIAM also describes the wide range of different types of wetland assessment and shows how these are interrelated and should be used for different purposes. It also includes a summary of the framework for wetland monitoring, which is directly relevant to wetland site management processes, and which is included in full in Handbook 18, *Managing wetlands*, 4th edition.

A key purpose of monitoring and assessment is to enable the detection and response to changes or likely changes in wetland ecological character. COP10's guidance on describing the ecological character of wetlands, and on processes of detecting, reporting and responding to change in wetland ecological character, is covered in 4th edition Handbooks 15 and 19 respectively, but is also referred to here.

An Integrated Framework for wetland inventory, assessment and monitoring (IF-WIAM)

(adopted as Annex E to Resolution IX.1 by the 9th meeting of the Conference of the Contracting Parties, Kampala, Uganda, 2005)

Relevant implementation commitments made by Contracting Parties in COP Resolutions and Recommendations

Resolution IX.1: Additional scientific and technical guidance for implementing the Ramsar wise use concept

THE CONFERENCE OF THE CONTRACTING PARTIES

7. WELCOMES the frameworks, guidelines and other advice provided as annexes C, D, and E to this Resolution and URGES Contracting Parties to make good use of them as appropriate [...];
8. URGES Contracting Parties to draw these frameworks, guidelines and other advice to the attention of all relevant stakeholders, including *inter alia* government ministries, departments and agencies, water and basin management authorities, non-governmental organizations, and civil society; and FURTHER URGES Contracting Parties to encourage these stakeholders to take these guidelines into account [...] in their decision-making and activities which relate to the delivery of the wise use of wetlands through the maintenance of their ecological character.

Resolution X.15: Describing the ecological character of wetlands, and data needs and formats for core inventory: harmonized scientific and technical guidance

THE CONFERENCE OF THE CONTRACTING PARTIES

7. INVITES Contracting Parties and those responsible for the management of Ramsar sites to apply these guidelines in the preparation of ecological character descriptions of Ramsar sites, and as part of their management planning processes, so that these descriptions constitute a complementary basis to the Information Sheets on Ramsar Wetlands (RIS) for detecting and notifying changes in ecological character, as established through Article 3.2 of the Convention text, and RECOMMENDS that Contracting Parties provide any completed descriptions of the ecological character of Ramsar sites to the Secretariat as a supplement to the information provided in the RIS.

Resolution X.16: A Framework for processes of detecting, reporting and responding to change in wetland ecological character

THE CONFERENCE OF THE CONTRACTING PARTIES

4. WELCOMES the “Framework for processes of detecting, reporting and responding to change in wetland ecological character” provided in the annex to this Resolution, and URGES Contracting Parties to make good use of it as appropriate.

I. Background

1. Considerable attention has been paid by the Convention on Wetlands (Ramsar, Iran, 1971) to the importance of wetland inventory, assessment and monitoring as tools for the conservation and wise use of wetlands, as well as to their use through management planning processes to maintain and enhance the ecological character of Ramsar Sites and other wetlands under Article 3 of the Convention.

2. This has led to the adoption of a substantial suite of guidelines and other technical guidance on these matters by the meetings of the Conference of the Parties to the Convention, materials which have been designed to assist Contracting Parties and others in implementing these key Convention processes. Guidance adopted up to and including [COP10 (Changwon, Republic of Korea, 2008)] has been incorporated into Ramsar Wise Use Handbooks ([4th] edition) [15 (*Wetland inventory*), 16 (*Impact assessment*), 17 (*Designating Ramsar Sites*), 18 (*Managing wetlands*) and 19 (*Addressing change in wetland ecological character*)].
3. Furthermore, the Contracting Parties called in several COP8 Resolutions for the Scientific and Technical Review Panel (STRP) to prepare further guidance on different aspects of wetland inventory and assessment in order to fill gaps in the current toolkit. These include the “Ecological ‘outcome-oriented’ indicators for assessing the implementation effectiveness of the Ramsar Convention” (Resolution IX.1 Annex D), and “Guidelines for the rapid assessment of inland, coastal and marine wetland biodiversity” (Resolution IX.1 Annex E i.). Further detailed methodological guidance on several types of wetland assessment is being prepared by the STRP for publication as *Ramsar Technical Reports*.
4. Parties at Ramsar COP8 also requested the STRP to undertake and report on assessment of the status and trends in the ecological character of Ramsar Sites, as far as possible within the wider context of the status and trends of inland, coastal and marine wetlands (Resolution VIII.8), including through the work of the Millennium Ecosystem Assessment (MA) and through contributing to the work of the Convention on Biological Diversity (CBD) in developing and reporting on indicators of the status and trends for inland waters and coastal and marine biodiversity (Resolutions VIII.7 and VIII.8).
5. At COP8 Contracting Parties recognized that, with this increasingly large suite of guidance on different aspects of wetland inventory, assessment and monitoring, there is a need to provide overall guidance to Parties and others on when and for what purposes to use the various different inventory, assessment and monitoring tools and guidelines, and in Resolution VIII.7 the Parties requested the STRP to consider the consolidation of the Convention’s guidance in the form of an integrated framework for wetland inventory, assessment and monitoring.
6. The integrated framework provided here focuses on the purposes of and interrelationships among the different aspects and tools for wetland inventory, assessment and monitoring and provides summary information on each aspect of the relevant guidance adopted by the Convention. It also includes additional aspects of guidance requested by Resolution VIII.7.
7. The integrated framework provides a rationale for applying the mechanisms of the Convention for inventory, assessment and monitoring in order to increase public and political awareness and understanding of the critical values and functions of wetlands in supporting sustainable development and human well-being; provides general guidance for further steps to be taken to improve inventory, assessment and monitoring processes; and recognizes some key topics requiring further guidance and elaboration under the Convention to support full implementation of the framework.

8. The related Resolution VIII.7 request for harmonization of definitions and terms throughout the suite of Ramsar guidance on inventory, assessment, monitoring and management of the ecological character of wetlands is addressed by Resolution IX.1 Annex A as part of the “Conceptual Framework for the wise use of wetlands and the maintenance of their ecological character” [incorporated in Handbook 1, *Concepts and approaches for the wise use of wetlands*].

II. The importance of identifying, assessing and reporting the status of Ramsar Sites and other wetlands in the implementation of the Convention

9. The delivery of the conservation and wise use of wetlands, in line with the commitments embodied in the Ramsar Convention, entails:
 - a) establishing the location and ecological characteristics of wetlands (baseline inventory);
 - b) assessing the status, trends and threats to wetlands (assessment);
 - c) monitoring the status and trends, including the identification of reductions in existing threats and the appearance of new threats (monitoring); and
 - d) taking actions (both *in situ* and *ex situ*) to redress any such changes causing or likely to cause damaging change in ecological character (management).
10. At the site scale, the Convention’s guidance on management planning, including the *New Guidelines for management planning for Ramsar Sites and other wetlands* (Resolution VIII.14; Ramsar Wise Use Handbook [18, 4th edition]), stresses that establishing the ecological character features of a site, and the factors that are positively or adversely affecting or likely to affect this character, is essential to the implementation of an effective management planning process.
11. At regional and global scales an understanding of the status and trends of wetland ecosystems has been recognized as an essential basis for the establishment of national and international policies, strategies and priorities for actions.
12. Monitoring and reporting the conservation status of designated Ramsar Sites and other wetlands will also provide an indication of the success of the Ramsar Convention as an international treaty and its mechanisms for achieving wetland conservation and wise use. Resolution VII.11 is explicit in Objective 4.1 of the *Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance*: “To use Ramsar Sites as baseline and reference areas for national, supranational/regional, and international environmental monitoring to detect trends in the loss of biological diversity, climate change, and the processes of desertification.” The Convention’s “Ecological ‘outcome-oriented’ indicators for assessing the implementation effectiveness of the Ramsar Convention” (Resolution IX.1 Annex D) have been designed to address this issue [...].

See also Handbook 17, Designating Ramsar sites

13. A number of studies have drawn together available information on the distribution, status and trends of wetland ecosystems and have shown substantial gaps in available information:
 - i) The *Global Review of Wetland Resources and Priorities for Wetland Inventory [GRoWI]*, undertaken by eriss (Australia) and Wetlands International for the Convention in 1999, found that at that time only 7% of countries had adequate national wetland inventory and 25% of countries had no available national wetland inventory. Parties' National Reports to COP8 indicated that although this situation had somewhat improved – 28 Parties indicated that they have comprehensive wetland inventory with national coverage (24%) and a further 51 that they had partial inventories (COP8 DOC.5) – there remain large gaps in the baseline information about the location and characteristics of wetlands. [All GRoWI reports are available at: <http://www.wetlands.org/RSIS/WKBASE/GRoWI/welcome.html>].
 - ii) The MA's synthesis report for the Ramsar Convention (*Ecosystems and Human Well-being: Wetlands and Water. Synthesis*), published in 2005, has concluded that "there is insufficient information on the extent of all wetland types such as inland wetlands that are seasonally or intermittently flooded and some coastal wetlands to document the extent of wetland loss globally". Nevertheless this report has concluded that on available evidence past losses and present rates of loss and decline of inland and coastal wetland ecosystems and their wetland-dependent species are greater than those in marine and terrestrial ecosystems. [The synthesis report is available at: <http://www.maweb.org/en/index.aspx>].
14. By 2002, management plans, including monitoring programmes, were in place for all designated Ramsar Sites in only 24 Contracting Parties (20%) (COP8 DOC. 6), and the use of the Ramsar Sites network as a national and international network for monitoring the status and trends of wetland ecosystems, as envisaged by Objective 4.1 of the *Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance* (Resolution VII.11), had not yet been established.
15. There is thus a need to ensure more comprehensive collection and reporting of such information essential for determining future policies and priorities for wetland conservation and wise use, underpinned by a clearer understanding of the purposes and objectives of inventory, assessment and monitoring.
16. A number of inventory and assessment initiatives that have recently been developed or are ongoing support Convention implementation of different aspects of this integrated framework. These include:
 - i) further development and elaboration of the Mediterranean Wetlands Initiative (MedWet) inventory methodology through the European Union-funded SUDOE and CODDE projects (see [<http://www.medwet.org/2010/03/sudoe-inventory-assesment-and-monitoring-for-wetland-management/>]; and [<http://www.medwet.org/2010/03/codde/>]);

- ii) the development of the Asian Wetland Inventory methodology, a multiple purpose and multi-scalar approach (see also section 4 below, and [...] (Finlayson C.M., Begg G.W., Howes J., Davies J., Tagi K. & Lowry J. 2002. A manual for an inventory of Asian wetlands (version 1.0). *Wetlands International Global Series 10*, Wetlands International, Kuala Lumpur, Malaysia. 72 pp. Downloadable in English and five Asian languages from: [<http://www.wetlands.org/RSIS/WKBASE/awi/default.htm>]);
- iii) the first phase of a Pan-European wetland inventory project, undertaken by Wetlands International and RIZA, the Netherlands (see [<http://www.wetlands.org/RSIS/WKBASE/Default.html>]), which expanded and updated the European component of the 1999 *Global Review of Wetland Resources and Priorities for Wetland Inventory*;
- iv) the preparation through the STRP of a wetland inventory metadatabase model (in response to Resolution VIII.6) for a creation of a standardised record of information about each wetland inventory (see also section 5) [...];
- v) the European Space Agency's TESEO and GlobWetland projects, which [have developed] demonstration products based on earth observation (remote sensing) to improve the ability of wetland managers to better monitor and assess the condition of wetlands within their respective countries ([for example, see the first Globwetland project at] <http://www.globwetland.org/>);
- vi) The methodologies and results of the Millennium Ecosystem Assessment (MA), focusing on assessment of ecosystem services and human well-being (reports, in the three Convention languages and several others, available on: <http://www.millenniumassessment.org/en/index.aspx>); and
- vii) The CGIAR Comprehensive Assessment of Water [Management in] Agriculture [see <http://www.iwmi.cgiar.org/assessment/>], led by the International Water Management Institute (IWMI), Sri Lanka, which is preparing a special report on wetlands, water and agriculture for the Ramsar Convention, based on a series of questions developed by the STRP.

III. The relationship between wetland inventory, assessment, monitoring and management

17. Working definitions for wetland inventory, assessment and monitoring are incorporated into Ramsar's *Framework for Wetland Inventory* (Resolution VIII.6). They are:

Wetland Inventory: the collection and/or collation of core information for wetland management, including the provision of an information base for specific assessment and monitoring activities.

Wetland Assessment: the identification of the status of, and threats to, wetlands as a basis for the collection of more specific information through monitoring activities.

Wetland Monitoring: the collection of specific information for management purposes in response to hypotheses derived from assessment activities, and the use of these monitoring results for implementing management. The collection of time-series information that is not hypothesis-driven from wetland assessment is here termed *surveillance* rather than monitoring (refer to Resolution VI.1).

18. The approach and the scope of activity for inventory, assessment and monitoring as separate components of the management process differ substantially, but these are not always well distinguished in implementation projects.
19. Importantly, wetland inventory and wetland monitoring require different types of information. Whilst wetland inventory provides the basis for guiding the development of appropriate assessment and monitoring, wetland inventories repeated at given time intervals do not in themselves constitute monitoring.
20. Essentially, wetland (baseline) inventory is used to collect information to describe the ecological character of wetlands; assessment considers the pressures and associated risks of adverse change in ecological character; and monitoring, which can include both survey and surveillance, provides information on the extent of any change. All three are important and interactive data gathering exercises. They should be considered as linked elements of this overall integrated framework which, when implemented, provides for identification of key features of the character of wetlands. Taken together, they provide the information needed for establishing strategies, policies and management interventions to maintain the defined wetland ecosystem character and hence ecosystem benefits/services.
21. However, in practice a clear distinction between inventory and assessment is hard to draw, and many projects and initiatives described as wetland inventory also include elements of assessment of the status of, and pressures and threats to, wetlands.
22. The data and information collected through inventory, assessment and monitoring are essential parts of an overall wetland management planning process, at site, catchment, national or regional scales. The management planning process provides the mechanisms for maintenance of the ecological character of the wetlands, drawing on the data and information provided by inventory, assessment and monitoring, as is set out in the Convention's *New Guidelines for management planning for Ramsar Sites and other wetlands* adopted by COP8 (Resolution VIII.14) [incorporated in Handbook 18, *Managing wetlands*].

IV. Multi-scalar approaches to wetland inventory, assessment and monitoring

23. Key issues in implementing wetland inventory, assessment and monitoring are the choice of the scale at which to undertake the work and the choice of appropriate methods for each scale.

24. Wetland assessment, as with inventory and monitoring, can be undertaken at discrete spatial scales using (different) appropriate techniques for each. Whenever possible, an integrated inventory, assessment and monitoring programme should be developed and conducted at a single appropriate scale. This can be achieved when an integrated analysis encompassing inventory, assessment and monitoring components is planned and implemented. However, these components are typically planned or undertaken separately. Wetland assessment should be undertaken at a spatial scale compatible with the scale of information contained within the wetland inventory. Subsequent monitoring should also be undertaken at a scale compatible with the assessment.
25. Since much wetland inventory, assessment and monitoring will be constrained by the scale and availability of information, practitioners are encouraged to aggregate data wherever possible rather than attempt to disaggregate data. This is possible when subsequent analyses draw on data from larger scales (e.g., combining data collected at 1:10,000 scale to represent a composite image at 1:50,000 scale) rather than smaller scales where issues of accuracy and precision will likely constrain effective analysis.
26. The issue of scale has so far been most fully addressed in methodologies for wetland inventory, and this is summarized below, using the Asian Wetland Inventory method as an example. However, many of the scale issues for inventory are equally relevant for the application of wetland assessment and monitoring, but further evaluation of options for these elements of the overall process may be necessary.
27. Wetland inventory has been carried out at a number of spatial scales, with specific purposes at each scale. These cover:
 - i) global – purpose: presence/absence of wetlands in continents and islands;
 - ii) continental – purpose: distribution of regions dominated by wetlands within continents or islands;
 - iii) regional – purpose: range of specific wetland types;
 - iv) local – purpose: characteristics of individual wetlands; and
 - v) site – purpose: variability within individual wetlands.
28. Some wetland inventory methodologies, notably the Mediterranean Wetland Inventory and, more recently, the Asian Wetland Inventory (AWI), have been developed as multi-scalar approaches and have been recognized by the Ramsar Convention as appropriate for application for a variety of purposes. Depending on particular local, national and regional needs and priorities, they can be implemented at one or more scales, and their methods may be applied also to other regions of the world.
29. The Asian Wetland Inventory has been developed with multiple purposes in mind. These take into account the need for information at multiple scales (local to global) and include the need to:
 - i) develop standardised field data collection sheets; and
 - ii) provide core data/information on wetlands to support international conventions and treaties on wetlands, climate change, biodiversity,

migratory species and desertification, and their implementation by governments;

in order to:

- i) analyse long-term trends in wetlands and their natural resources;
 - ii) enable regular revisions and updates of information on wetlands of national and international importance; and
 - iii) disseminate these analyses for wider consideration and use in sustainable development and conservation of wetland resources.
30. The key feature of the AWI is the production of hierarchical and map-based outputs at four levels of detail. The level of detail is related to the scale of the maps that are contained within a standardised GIS format with a minimum core data set. The hierarchical approach comprises a progression in scale from river basins to individual sites (see Figure 1).
31. The initial analysis (level 1) involves delineation of geographical regions (major river basins and islands) in Asia and encompasses a description of the geology, climate and ecology of each based on existing information sources. Level 2 analysis concerns delineation of wetland regions within each geographic region. This is done on the basis of similar climatic, geologic, hydrologic and vegetation features. Level 3 analysis undertakes grouping and description of wetland complexes within each region on the basis of more detailed information. Finally, level 4 analysis makes detailed descriptions of individual wetland habitats.
32. This approach results in the production of more detailed information on wetlands as the inventory progresses from levels 1 to 4, and it is anticipated that in many cases the implementation of an inventory will initially be undertaken at levels 1 and 2, followed, as resources become available, by levels 3 and 4.
33. While a hierarchical framework has been developed, it is not essential for all purposes to work through all levels of detail. The hierarchical approach is designed to respond to existing needs to obtain information at different levels and detail. A key point of this approach, however, is the adoption of compatible data fields and data management procedures to allow maximum use of the data, whether this is immediately planned or not for the particular purpose of an inventory exercise. However, for such reuse for different purposes, it is important to recognize the limits or constraints on interpretation of the original data.
34. At all levels of analysis the usefulness of existing information is first assessed and used as a basis for determining whether or not further analysis or collection of information is necessary. In many instances, analyses will be undertaken as follows:
- Level 1 – desk study to describe the broad geologic, climatic and ecological features of each geographic region using existing datasets, increasingly available on the Internet;
- Level 2 – desk study to identify the wetland regions within each geographic region using information already collated on geology, climate, hydrology, and vegetation;

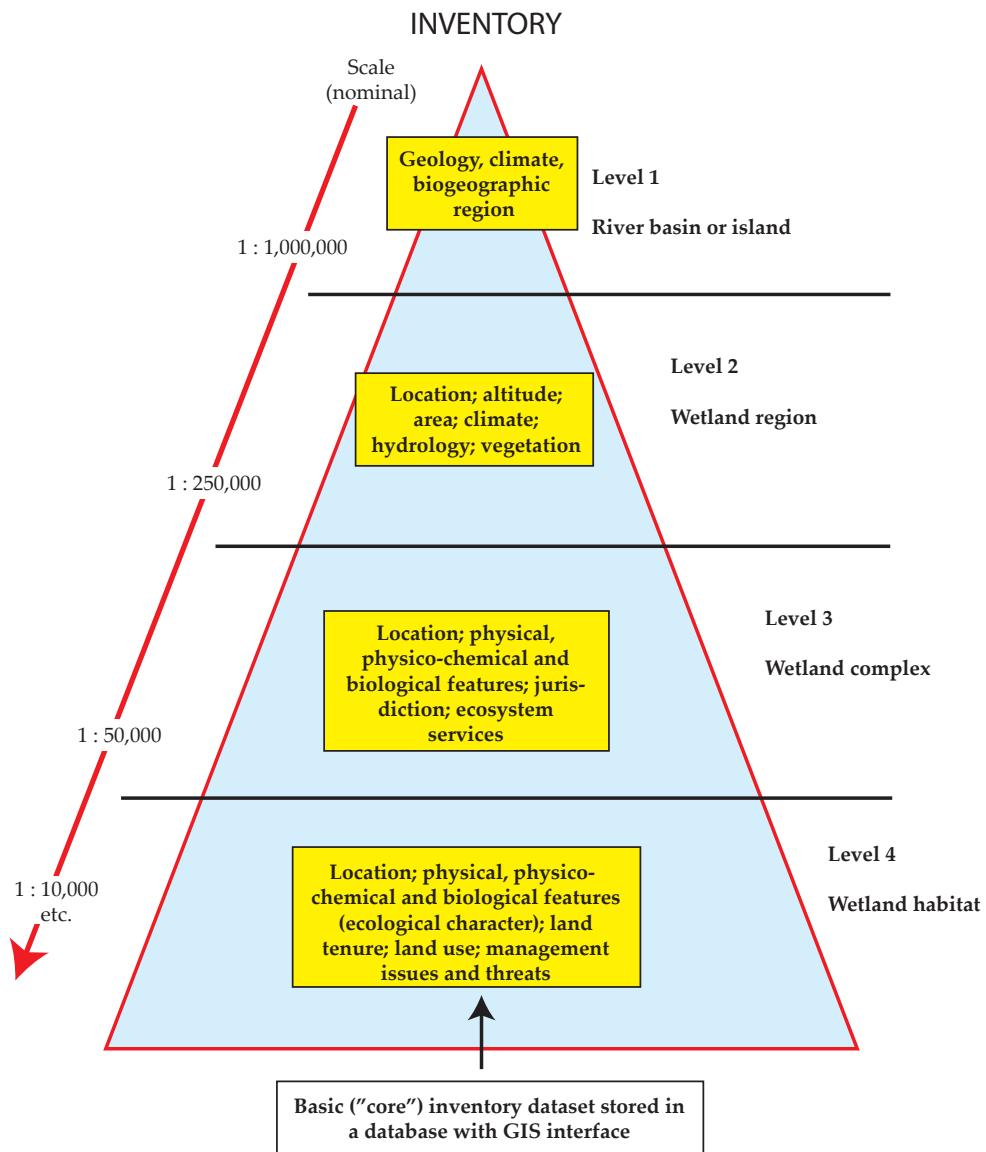


Figure 1. The hierarchical approach to wetland inventory. Data fields most appropriate for each level are shown, with the most data being collected at level 4 (shown at the base of the triangle).

Level 3 – fieldwork and analysis to identify the physical, physico-chemical and biological features of wetland complexes within each wetland region; and

Level 4 – detailed fieldwork and analysis to describe the physical, physico-chemical and biological features of each wetland habitat within each wetland complex. This includes information on plant and animal assemblages and species, land and water use and wetland management. [See also Resolution X.15, *Describing the ecological character of wetlands, and data needs and formats for core inventory: harmonized scientific and technical guidance.*]

35. Data collection and analysis is based on standardised procedures and data management formats, although flexibility is not discouraged where

necessary. Proforma data sheets for each level of analysis have been developed and are accompanied by guidelines for collecting the required information.

36. Similar multi-scalar procedures can be developed for wetland assessment and monitoring. These procedures will most likely build on the multi-scalar information collected under the inventory process and provide managers and others with analyses suitable for the scale of investigation.
37. However, detailed monitoring at broad scales is usually not possible because of its high cost, and thus monitoring at this scale must be cost-effective and sufficiently rapid to generate adequate first-pass data over large areas. The data may be adequate for management purposes or they may help managers to decide what type of further information may be required.
38. Typically, rapid assessment methods, including rapid biological assessment (see also Appendix 1) and remote sensing, are applied at broad scales. For specific sites, however, more detailed, quantitative monitoring may be required, utilising designs that provide stronger inference about a putative impact.

V. The Ramsar ‘toolkit’ of guidance available to Ramsar Parties for implementing the integrated wetland inventory, assessment and monitoring framework

39. A substantial set of Ramsar guidance already exists for wetland inventory, assessment, monitoring, and management. Guidance adopted up to and including [COP10] has been compiled in Ramsar Wise Use Handbooks [(4th Edition) 15, 16, 18 and 19, as well as the present Handbook]. Key guidelines, definitions and other relevant guidance is listed in Table 1. Key aspects and features of the Convention’s guidance on wetland inventory, assessment and monitoring are summarized in the following sections of this integrated framework.

Table 1. Guidance available through the Ramsar Convention for implementing wetland inventory, assessment, monitoring and management. Note that a number of the wetland management guidances include aspects related to wetland inventory and assessment techniques.

COP Resolution and other sources	Guidance compiled in Ramsar Handbooks [(4th Edition, 2010), Ramsar Technical Reports]
Wetland inventory, assessment & monitoring	
Definition of “Wise Use” (Recommendation 3.3) [now updated in Resolution IX.1 Annex A]	1. [Concepts and approaches for the wise use of wetlands]
Definitions of “ecological character” and “change in ecological character” (Resolution VII.10). [updated in Resolution IX.1 Annex A]	1. [Concepts and approaches for the wise use of wetlands]
<i>Conceptual Framework for the wise use of wetlands and the maintenance of their ecological character</i> (Resolution IX.1 Annex A)	1. [Concepts and approaches for the wise use of wetlands]

<i>Integrated framework for wetland inventory, assessment and monitoring (Resolution IX.1 Annex E)</i>	This Handbook
[...] [Describing the ecological character of wetlands, and data needs and formats for core inventory: harmonized scientific and technical guidance (Resolution X.15)]	[15]. Wetland inventory
<i>Guidelines for Global Action on Peatlands (Resolution VIII.17)</i>	[15]. Wetland inventory & [18], Managing wetlands
Guidance for GIS applications for wetland inventory, assessment and monitoring [...]	Ramsar Technical Report 2
Wetland inventory	
<i>A Framework for Wetland Inventory (Resolution VIII.6)</i>	[15]. Wetland inventory
Wetland assessment	
<i>Wetland risk assessment framework (Resolution VII.10)</i>	[18]. Managing wetlands
<i>Assessing and reporting the status and trends of wetlands, and the implementation of Article 3.2 of the Convention (Resolution VIII.8)</i>	[19]. Addressing change in [wetland] ecological character
[A Framework for processes of detecting, reporting and responding to change in wetland ecological character (Resolution X.16)]	[19]. Addressing change in wetland ecological character]
[...] [Environmental Impact Assessment and Strategic Environmental Assessment: updated scientific and technical guidance (Resolution X.17)]	[16]. Impact assessment
<i>Guidelines for the rapid assessment of inland, coastal and marine wetland biodiversity (Resolution IX.1 Annex E i.)</i>	Ramsar Technical Report 1
<i>Ecological 'outcome-oriented' indicators for assessing the implementation effectiveness of the Ramsar Convention (Resolution IX.1 Annex D)</i>	-
[...] [Guidance for valuing the benefits derived from wetlands ecosystem services]	Ramsar Technical Report 3
Methodologies for assessing the vulnerability of wetlands to change in their ecological character	(Ramsar Technical Report in preparation)
Methodologies for assessing the environmental water requirements of wetlands	(Ramsar Technical Report in preparation)
Wetland monitoring	
<i>A Framework for designing a wetland monitoring programme (Annex to Resolution VI.1)</i>	[18]. Managing wetlands
Wetland management	

<i>New Guidelines for management planning for Ramsar Sites and other wetlands (Resolution VIII.14)</i>	[18]. Managing wetlands
<i>Principles and guidelines for wetland restoration (Resolution VIII.16)</i>	[19]. Addressing change in [wetland] ecological character
<i>Guidelines for establishing and strengthening local communities' and indigenous people's participation in the management of wetlands (Resolution VII.8)</i>	[7]. Participatory skills
<i>Participatory Environmental Management (PEM) as a tool for the management and wise use of wetlands (Resolution VIII.36)</i>	[7]. Participatory skills
<i>[Wetlands and river basin management: consolidated scientific and technical guidance (Resolution X.19)]</i>	[9]. River basin management
<i>Principles and guidelines on integrated coastal zone management (Resolution VIII.4)</i>	[12]. Coastal management
<i>Guidelines for the allocation and management of water for maintaining the ecological functions of wetlands (Resolution VIII.1)</i>	[10]. Water allocation and management
<i>Guidelines for Global Action on Peatlands (Resolution VIII.17)</i>	[18]. Managing wetlands
<i>Guidelines for the management of groundwater to maintain wetland ecological character (Resolution IX.1 Annex C ii.)</i>	[11]. Managing groundwater

40. In addition, there are a number of other ecosystem and wetlands and water-related global assessment initiatives [in existence], whose methodologies may be of relevance to any further development and implementation of this integrated framework. These include, *inter alia*, the Millennium Ecosystem Assessment (MA), the Global International Waters Assessment (GIWA), UN Waters' World Water Assessment Programme (WWAP), the CGIAR Comprehensive Assessment of Water [Management in] Agriculture, and the IUCN Species Survival Commission's Freshwater Biodiversity Assessment Programme.
41. Furthermore, the assessment results of these and other synthesised assessments such as UNEP's Global Environmental Outlook (GEO) and CBD's Global Biodiversity Outlook (GBO) will provide assessment information helpful for decision-making and identification of priorities for the future conservation and wise use of wetlands in their broader landscape/seascape context.

The Ramsar Framework for Wetland Inventory

See also Handbook 15, Wetland inventory

42. The *Framework for Wetland Inventory* was adopted by COP8 in Resolution VIII.6[, as amended by Resolution X.15]. It provides a 13-step structured framework, supported by guidance on each step, for planning a wetland inventory. These steps are:
 1. State the purpose and objective
 2. Review existing knowledge and information

3. Review existing inventory methods
 4. Determine the scale and resolution
 5. Establish a core or minimum data set
 6. Establish a habitat classification
 7. Choose an appropriate method
 8. Establish a data management system
 9. Establish a time schedule and the level of resources that are required
 10. Assess the feasibility & cost effectiveness
 11. Establish a reporting procedure
 12. Establish a review and evaluation process
 13. Plan a pilot study
43. This planning framework is supported by examples of successfully applied standardized inventory methodologies from different regions, guidance on determining the most appropriate remotely-sensed data for a wetland inventory, a summary of different widely-used wetland classifications, and a standard metadata record for the documentation of wetland inventories.
44. The *Framework for Wetland Inventory* identifies a set of core (minimum) data fields for [...] wetlands (Table 2) which should be collected in each inventory, depending on the specific purpose of the inventory.

Table 2. Core (minimum) data fields for [wetland inventory (derived from the Annex to Resolution X.15)]

Revised core wetland inventory fields (Harmonized with Ramsar ecological character description sheet)	
Site name:	Official name of site and catchment/other identifier(s) (e.g., reference number)
Area, boundary and dimensions:	Site shape (cross-section and plan view), boundaries, area, area of water/wet area (seasonal max/min where relevant), length, width, depth (seasonal max/min where relevant)
Location:	Projection system, map coordinates, map centroid, elevation
Geomorphic setting:	Setting in the landscape/catchment/river basin - including altitude, upper/lower zone of catchment, distance to coast where relevant, etc.
Biogeographical region:	
Climate:	Overview of prevailing climate type, zone and major features (precipitation, temperature, wind)
Soil:	Geology, soils and substrates; and soil biology
Water regime:	Water source (surface and groundwater), inflow/outflow, evaporation, flooding frequency, seasonality and duration; magnitude of flow and/or tidal regime, links with groundwater
Water chemistry:	Temperature; turbidity; pH; colour; salinity; dissolved gases; dissolved or suspended nutrients; dissolved organic carbon; conductivity

Biota: Plant communities, vegetation zones and structure (including comments on particular rarity, etc.); Animal communities (including comments on particular rarity, etc.); Main species present (including comments on particular rare/endangered species, etc.); population size and proportion where known, seasonality of occurrence, and approximate position in distribution range (e.g., whether near centre or edge of range)
Land use: Local, and in the river basin and/or coastal zone
Pressures and trends: Concerning any of the features listed above, and/or concerning ecosystem integrity
Land tenure and administrative authority: For the wetland, and for critical parts of the river basin and/or coastal zone
Conservation and management status of the wetland: Including legal instruments and social or cultural traditions that influence the management of the wetland; and including protected area categories according to the IUCN system and/or any national system
Ecosystem services: (for a list of relevant ecosystem services, see the Ramsar ecological character description sheet)
Management plans and monitoring programs: In place and planned within the wetland and in the river basin and/or coastal zone (see Resolutions 5.7, VI.1, VII.17, and VIII.14)

45. The *Framework for Wetland Inventory* recognizes that wetland inventory has multiple purposes, including:
 - a) listing particular types, or even all, wetlands in an area;
 - b) listing wetlands of local, national and/or international importance;
 - c) describing the occurrence and distribution of wetland taxa;
 - d) describing the occurrence of natural resources such as peat, fish or water;
 - e) establishing a baseline for measuring change in the ecological character of wetlands;
 - f) assessing the extent and rate of wetland loss or degradation;
 - g) promoting awareness of the value of wetlands;
 - h) providing a tool for conservation planning and management; and
 - i) developing networks of experts and cooperation for wetland conservation and management.
46. The *Framework* also stresses that an inventory should contain a clear statement of its purpose and objective. This should identify the habitats that will be considered, the range of information that is required, the time schedule, and who will make use of the information. A clear statement of the purpose(s) will assist in making decisions about the methods and resources needed to undertake the inventory.
47. Unlike the use of wetland assessment techniques (see below), there is less likelihood that more than one inventory technique will be applied simultaneously. Since wetland inventory can be carried out at different levels of detail, it is far more likely that sequential inventory, starting simply and subsequently undertaking more detailed work, will be undertaken.

Metadata records for wetland inventory

See Ramsar Technical Report No. 4, Framework for a wetland inventory metadatabase

48. The *Framework for Wetland Inventory* also stresses the importance of establishing a publicly-accessible and standardized metadata record for each inventory undertaken, and it includes a standard model for wetland inventory metadata. Metadata has many elements that can include information describing the age, accuracy, content, currency, scale, reliability, lineage, authorship and custodianship of an individual dataset. Recording and describing this information enables data to be easily located, identified, understood and managed. It also enables data to be used more efficiently and effectively.
49. Whilst ‘metadata’ is not a new concept, it has gained added significance through the increasing recognition of data collections and associated information as assets which need to be managed and maintained efficiently. A *metadatabase* can be viewed as the mechanism which links all of these data descriptions together to provide a comprehensive description of the dataset. The metadatabase stores descriptions of the data, not the actual data itself. Where possible, the data fields should be populated with values representing established international standards, to ensure consistency and quality in the data entry. The extent of subjective individual interpretations or descriptions should be minimised where possible, to avoid confusion or inconsistency. This is a particular concern when data are exchanged between organizations. By identifying the fields required for the metadatabase and recommending the parameters and file formats, it is intended that the metadatabase could be produced on a range of database platforms. Using standardized parameters should assist with the transfer of data between platforms.

Types of wetland assessment

50. There is a wide range of different types and methods of wetland assessment relevant to different aspects of Convention implementation, with each suited to, and designed for, different purposes and situations. These include:
 - i) Environmental Impact Assessment (EIA)
 - ii) Strategic Environmental Assessment (SEA)
 - iii) Risk Assessment (RA)
 - iv) Vulnerability Assessment (VA)
 - v) Change (status and trends) assessment
 - vi) Species-specific assessment
 - vii) Indicator assessment
 - viii) Resource (ecosystem benefits/services) assessment
 - ix) Assessment of values of wetland benefits/services
 - x) Environmental water requirement (environmental flows) assessment
51. The Ramsar Convention has adopted guidance on a number of these types of assessments, and further guidance [...] is being prepared by the STRP for publication as *Ramsar Technical Reports* (see Table 1). Summary information on a number of these types of assessment guidance available to the Convention is provided in COP9 DOC. 24, [included as the Appendix to this Handbook].

Rapid assessment of wetlands

52. “Rapid assessment” of wetlands is an approach which, depending on the purpose of the assessment, involves one or more of the different types of wetland assessment listed in paragraph 50 above, but where the methods are adapted to permit the adequate collection, analysis and presentation of the assessment information when this information is urgently needed. It may also involve the rapid collection of ‘baseline’ wetland inventory information. Rapid assessment methods can be particularly useful in the assessment of the impacts of natural disasters such as storm surges, tsunamis and hurricanes.
53. Guidelines for the rapid assessment of inland water, coastal and marine biodiversity have been jointly developed by the Convention on Biological Diversity and the Ramsar Convention. A consolidated version of this guidance, covering the range of wetland types in the Ramsar Classification System, has been included in Resolution IX.1 Annex E i. This guidance focuses on assessments at the species level of biodiversity, and it recognizes that there is a need to develop rapid assessment guidance for wetland ecosystems further.
54. The guidance recognizes that the purposes for rapid assessment of wetlands include:
 - a) collecting general biodiversity data in order to inventory and prioritize wetland species, communities and ecosystems; obtaining baseline biodiversity information for a given area;
 - b) gathering information on the status of a focus or target species (such as threatened species); collecting data pertaining to the conservation of a specific species;
 - c) gaining information on the effects of human or natural disturbance (changes) on a given area or species;
 - d) gathering information that is indicative of the general ecosystem health or condition of a specific wetland ecosystem; and
 - e) determining the potential for sustainable use of biological resources in a particular wetland ecosystem.
55. The rapid assessment guidance in Resolution IX.1 Annex E i. includes a five-step procedure for designing a rapid assessment, modified from Ramsar’s structured framework for wetland inventory (Annex to Resolution VIII.6). Summary information on this approach to rapid assessment is also provided in COP9 DOC. 24 [see Appendix].

Indicator assessment

56. The development and use of indicators is designed to assess temporal patterns in the status and trends of ecosystems, habitats and species, the pressures and threats they face, and the responses made to address these pressures and threats. Such indicators are not designed to provide a complete and comprehensive assessment of all aspects of wetland ecosystems and their dynamics: rather they are intended to give a series of related pictures of these patterns, in order to guide further design and the focusing of decision-making for addressing unwanted change. Such

indicators are also generally components of hypothesis-driven wetland monitoring programmes (see below).

57. Ramsar has worked closely with the Convention on Biological Diversity in its development of a set of indicators designed to assess the progress towards achieving the 2010 target of significantly reducing the rate of loss of biodiversity. The results of assessment of many of these indicators, which will be reported through the CBD's *Global Biodiversity Outlook*, will have relevance to the delivery of wetland conservation and wise use under the Ramsar Convention. [Successor indicators will guide assessments in the period after 2010]. The CBD's 2010 global indicators [...] (UNEP/CBD/COP/7/20/Add.3) are:
 - i) trends in extent of selected biomes, ecosystems and habitats;
 - ii) trends in abundance and distribution of selected species;
 - iii) change in status of threatened species;
 - iv) trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socio-economic importance;
 - v) coverage of protected areas;
 - vi) criteria and indicators for sustainable management of ecosystems;
 - vii) biodiversity used in food and medicine;
 - viii) water quality in aquatic ecosystems;
 - ix) trophic integrity of ecosystem;
 - x) nitrogen deposition; and
 - xi) numbers and cost of alien invasions.
58. For Ramsar, and in response to Resolution VIII.26, the STRP has developed "Ecological 'outcome-oriented' indicators for assessing the implementation effectiveness of the Ramsar Convention", which are provided in Resolution IX.1 Annex D. These indicators seek to go beyond the assessment and reporting of the status and trends of different aspects of wetlands and their conservation and wise use (such as the CBD 2010 indicators), and they are formulated in such a way as to yield insights into the Convention's effectiveness, in conjunction with analysis of certain 'process-oriented indicators' such as those in the [format for National Reports to COPs].
59. An initial tranche of eight effectiveness indicators, some with one or more sub-indicators, has been developed, with a further five indicators recommended for further consideration and development. The initial eight indicators are:

Indicator	Sub-indicator(s)
A. The overall conservation status of wetlands	i. Status and trends in wetland ecosystem extent ii. Trends in conservation status – qualitative assessment
B. The status of the ecological character of Ramsar Sites	i. Trends in the status of Ramsar Site ecological character – qualitative assessment
C. Trends in water quality	i. Trends in dissolved nitrate (or nitrogen) concentration ii. Trends in Biological Oxygen Demand (BOD)
D. The frequency of threats affecting Ramsar Sites	i. The frequency of threats affecting Ramsar Sites – qualitative assessment

E. Wetland sites with successfully implemented conservation or wise use management plans	i. Wetland sites with successfully implemented conservation or wise use management plans
F. Overall population trends of wetland taxa	i. Trends in the status of waterbird biogeographic populations
G. Changes in threat status of wetland taxa	i. Trends in the status of globally-threatened wetland-dependent birds ii. Trends in the status of globally-threatened wetland-dependent amphibians
H. The proportion of candidate Ramsar Sites designated so far for wetland types/features	i. Coverage of the wetland resource by designated Ramsar Sites

60. [...] [The development of mechanisms for the implementation and assessment of these effectiveness indicators, and advice on a range of processes for reporting the results, is a continuing priority activity of the STRP (Resolution X.10 Annexes 1 and 2)].

The relationships among the different wetland assessment tools available through the Convention

61. Figure 2 illustrates the relationships among various assessment tools as a flow diagram that shows the linkages between the tools and the choices that may need to be made when assessing the condition of or change in a wetland.
62. The specific applications of each these individual assessment tools are summarized in COP9 DOC. 24 [see Appendix]. It is important to recognize that whilst each assessment tool has a specific application there can exist considerable overlaps between tools under some circumstances. In some instances, one or more specific tools can be used as part of a broader form of assessment. Practitioners need to consider the choice of tool or tools in relation to the specific purpose of the assessment they need to undertake.
63. The assessment tools and approaches shown in Figure 2 and described further in COP9 DOC. 24 are relevant in one way or another to assessing change or potential change in wetlands. These can be effectively integrated in a hierarchical decision-making framework, so that there is an efficient flow of information and influence from one to the other. Some of the ways in which this can occur are:
- *Strategic Environmental Assessment* can provide a framework or context which helps to determine the need for, and the parameters of, relevant project-specific *Environmental Impact Assessments*, focusing on key issues, priority risks and opportunities.
 - *Environmental Impact Assessment* can help determine the need for, and the parameters of, *Vulnerability and Risk Assessments* and *Wetland Valuations*.
 - *Vulnerability and Risk Assessments* help define baselines, tolerance limits and other elements to feed in to *Environmental Impact Assessment*,

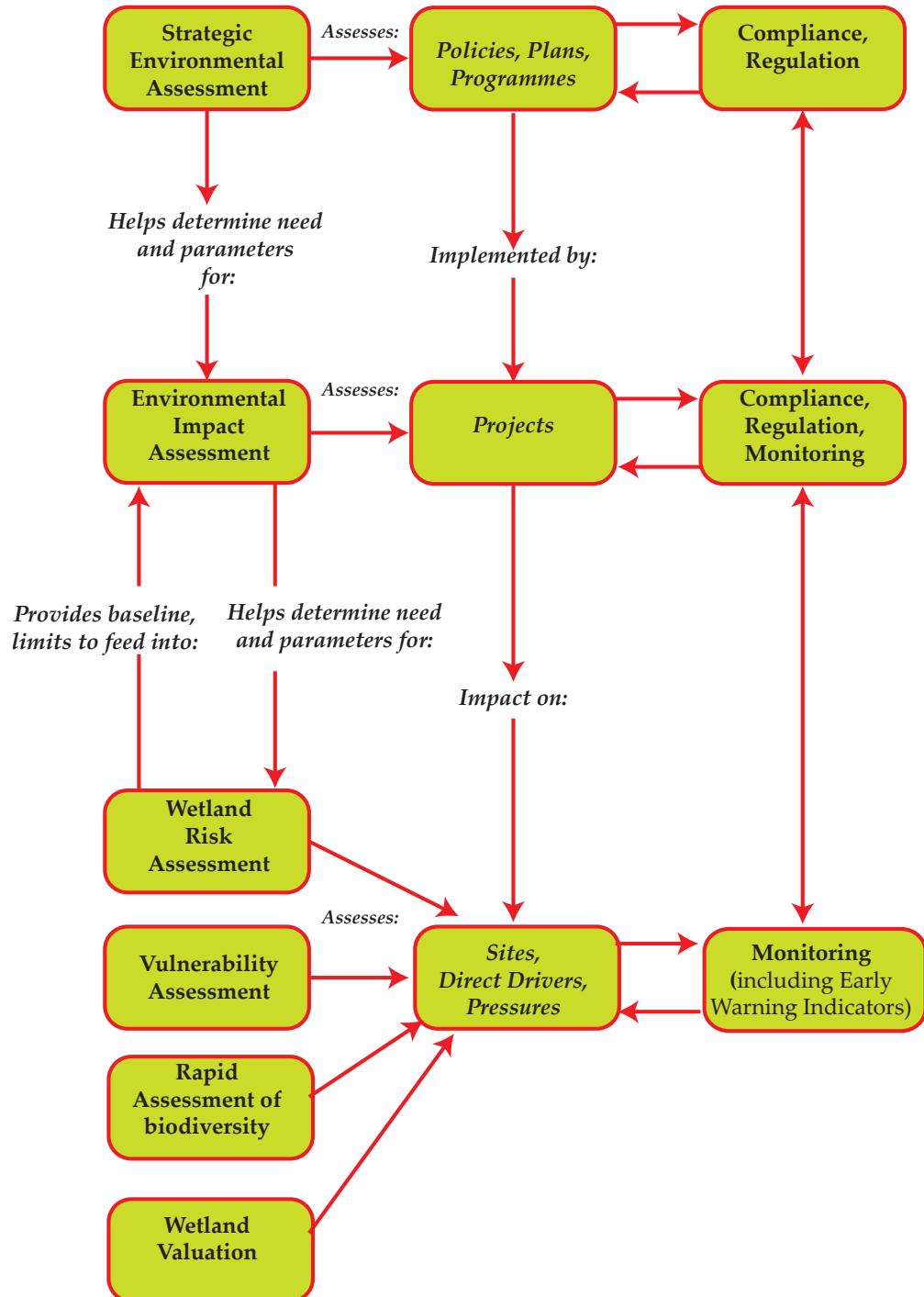


Figure 2. The relationships among the different wetland assessment tools available through the Convention

as well as potential measures for reducing the risk of wetland degradation.

- *Risk Assessment* can also quantify the magnitude and likelihood of impacts, as part of an *Environmental Impact Assessment*.

- Wetland Valuation (of ecosystem provisioning, regulating, cultural and supporting benefits/services) can provide information to assist in articulating the benefits obtained from a wetland and hence support the concepts provided in *Vulnerability and Risk Assessments*.
 - Information on impacts collected in the *Environmental Impact Assessment* process and through subsequent monitoring activities can feed into the *Strategic Environmental Assessment* process, as well as informing *Vulnerability and Risk Assessments* and *Wetland Valuations*.
 - Rapid Assessment of biodiversity provides information that can guide *Environmental Impact Assessment* and support *Vulnerability and Risk Assessment*, and identify elements of biodiversity that could be used within *Wetland Valuation*.
64. Thus Strategic Environmental Assessment, Environmental Impact Assessment, and Vulnerability and Risk Assessment will help define the scope of monitoring for policies/plans/programmes, for projects and for site management, respectively.
65. The Convention's *Wetland Risk Assessment Framework* (Resolution VII.10; Ramsar Handbook [18, 4th edition]) includes a substantial component addressing early warning indicators. Measurement of these indicators will draw on data from site management and monitoring and will feed back to adjustments in that management. Rapid Assessment of biodiversity can also provide early warning of impending change, but as illustrated in Figure 3 there is an inverse relationship between the extent of the ecological relevance of an indicator and the extent of early warning. Early warning indicators can also provide data to the monitoring stimulated in relation to projects by Environmental Impact Assessment.

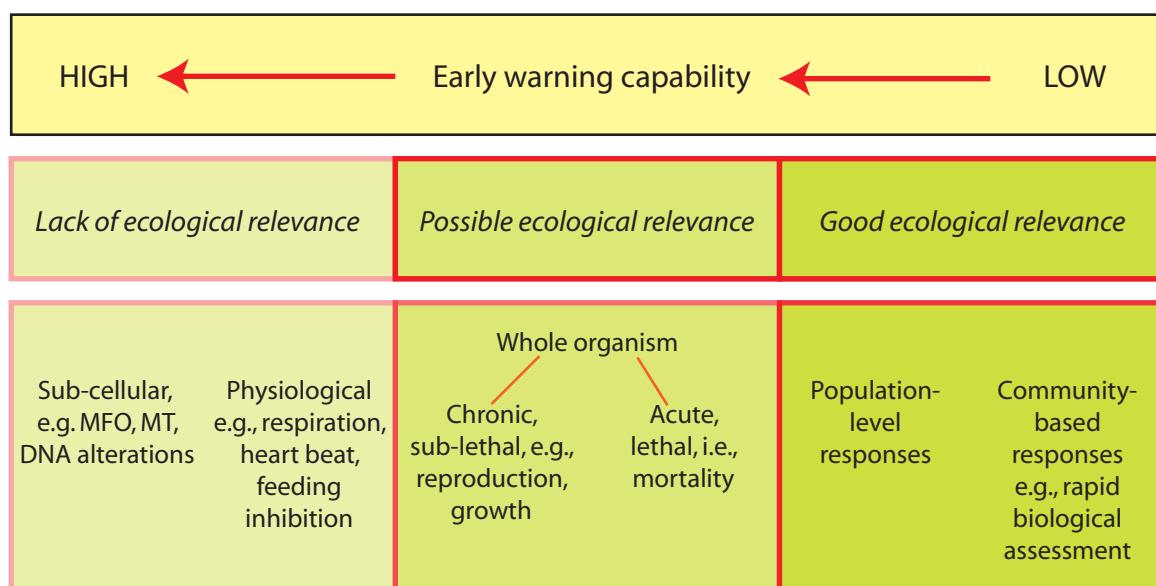


Figure 3. The relationship between ecological relevance and early warning capability to measure biological responses (from the Annex to Resolution VII.10 *Wetland Risk Assessment Framework*).

Wetland monitoring

66. A framework for designing a wetland monitoring programme was adopted by COP6 (Resolution VI.1) in 1996 and is incorporated into Ramsar Wise Use Handbook [18 (4th edition)] “Managing Wetlands”. This monitoring framework is summarized in Figure 4.
67. The framework is not a prescriptive recipe for any particular monitoring programme. It simply provides a series of steps that can be used by wetland managers and planners, working in partnership with local users and managers, to design a monitoring programme based on their particular circumstances and needs.
68. When designing a monitoring program it is necessary to consider a number of principles that ensure valid results, analysis and interpretation (see also Downes *et al.* 2002. *Monitoring Ecological Impacts: Concepts and Practice in Flowing Waters*. Cambridge University Press, Melbourne, Australia).
69. Many monitoring techniques are also available in the MedWet monitoring manual, which provides a listing and guidance on specific approaches (Tomas Vives, P. (ed). 1996 *Monitoring Mediterranean Wetlands: A Methodological Guide*. MedWet Publication, Wetlands International, Slimbridge, U.K. & ICN, Lisbon, Portugal) (downloadable from:[<http://www.medwet.org/2010/02/monitoring-mediterranean-wetlands-a-methodological-guide/>]).

Applying wetland inventory, assessment and monitoring tools in the context of the wise use of wetlands

70. This integrated framework for wetland inventory, assessment and monitoring, and the tools and methodologies it covers, forms one of several framework guidances developed by the STRP to assist Contracting Parties and others in more readily selecting and applying each of the increasing range of the Convention’s wetland conservation and wise use guidelines.
71. The STRP has also recognized the significance of the Millennium Ecosystem Assessment’s Conceptual Framework for Ecosystems and Human Well-being in providing an overarching framework for the delivery of Ramsar’s wise use of wetlands (Resolution IX.1 Annex A). It provides a multi-scalar approach which indicates how and where policy and management interventions, including the different components of the Convention’s toolkit of Wise Use Handbooks, can be made (see Figure 1 in Resolution IX.1 Annex A).
72. Within this conceptual framework, most of the Convention’s tools for inventory, assessment and monitoring concern the maintenance of the ecological character of wetlands through interventions within wetland ecosystems themselves – between the components and processes of wetlands and the ecosystem benefits/services these deliver. Others, notably Environmental Impact Assessment, Risk Assessment, and Vulnerability Assessment concern addressing the interactions between “Direct Drivers of Change” to wetlands and the wetlands themselves. However, since Strategic Environmental Assessment is concerned with policies, plans and

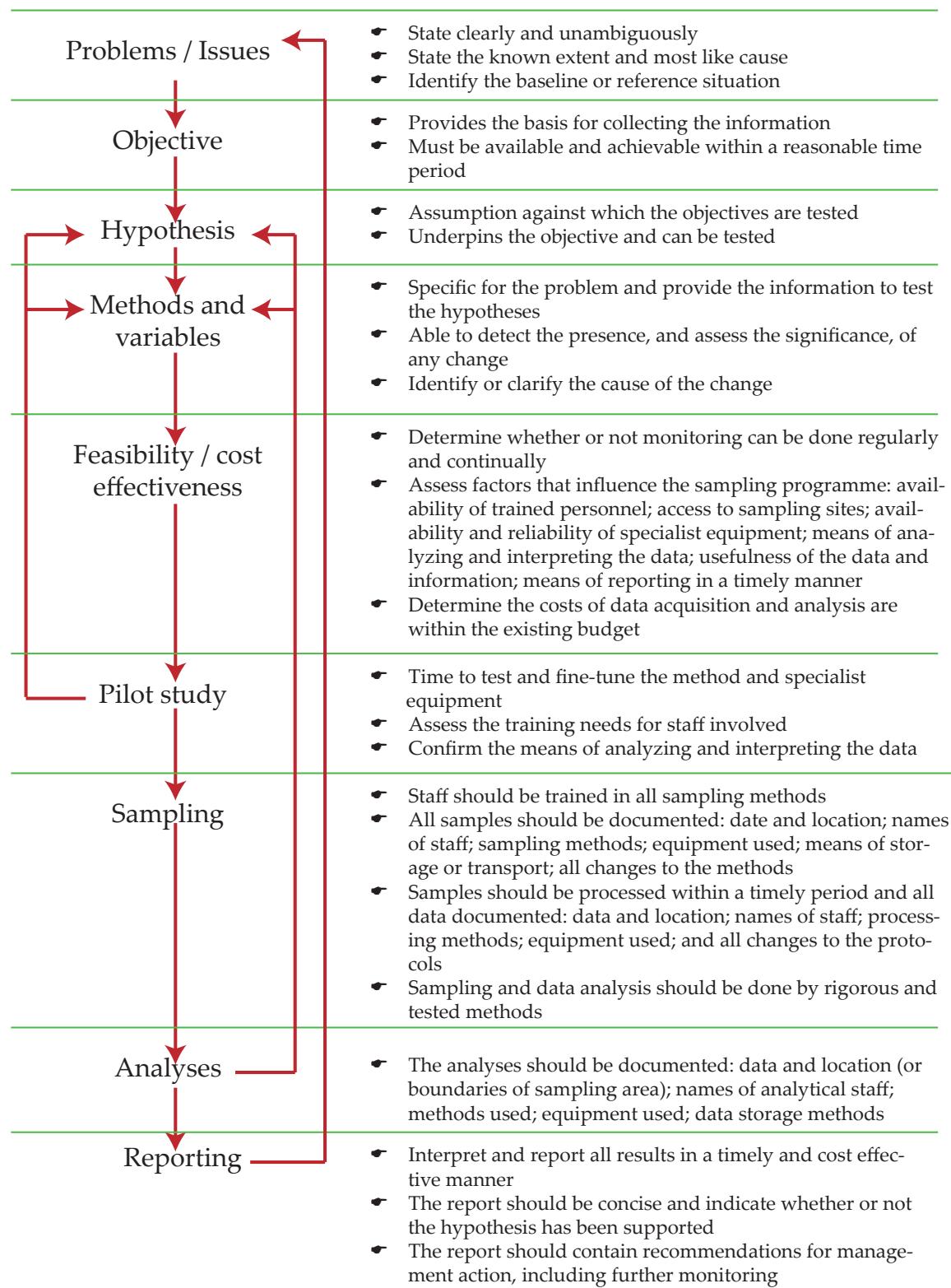


Figure 4. Framework for designing a wetland monitoring programme (from Ramsar Wise Use Handbook [18, 4th Edition]). The arrows illustrate the feedback which enables assessment of the effectiveness of the monitoring programme in achieving its objective(s).

programmes, it acts as an intervention between Indirect and Direct Drivers of Change.

[Applying wetland inventory, assessment and monitoring tools in the context of detecting, reporting and responding to change in the ecological character of wetlands

73. In addition to the assistance provided by this integrated framework to Parties in relation to the wise use requirement in Article 3.1 of the Convention, the framework is also relevant to the requirement in Article 3.2 to monitor, detect and report change or likely change in the ecological character of listed Ramsar Sites.
74. Guidance on compiling a baseline description of ecological character is provided in the Annex to Resolution X.15 (and in Ramsar Handbook 15, 4th edition); and the data fields in the “ecological character description sheet” provided there are harmonized with the revised core (minimum) data fields for wetland inventory in Table 2 above.
75. Resolution X.16, in its Annex, provides a *Framework for processes of detecting, reporting and responding to change in wetland ecological character*. This complements the framework in the present Handbook, by applying the results of inventory (in terms of ecological character description), assessment and monitoring to the specific purposes of Article 3.2, and then extending this to cover processes of reporting and responding to change or likely change in wetland ecological character.
76. Resolution IX.1 Annex A has linked the concepts of wise use and ecological character, through its updated definition of “wise use”, to the effect that: “Wise use of wetlands is the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development.” Hence although the framework in Resolution X.16 is designed in the first instance to assist with implementing Article 3.2 in relation to listed wetlands of international importance (Ramsar Sites), aspects of it can apply equally to the implementation of Article 3.1 in relation to wetlands in general.]

See also Handbook 19, Addressing change in wetland ecological character

VI. Gaps in Ramsar’s toolkit of inventory, assessment and monitoring guidance

77. Although this *Integrated Framework for wetland inventory, assessment and monitoring* now includes a large number of different tools and approaches, a number of gaps in methodological guidance remain before it provides a comprehensive Ramsar framework for implementation by Contracting Parties and others. These [have been] identified in [successive] schedule[s] of actions for the scientific and technical implementation of the Convention [...] ([e.g.] Annex 2 to Resolution IX.2 and Annex 2 to Resolution X.10). They include:
 - i) development and testing of a hydro-geomorphically-based system of classification of wetland types, including an evaluation of how this relates to other possible systems and to the current Ramsar classification system;

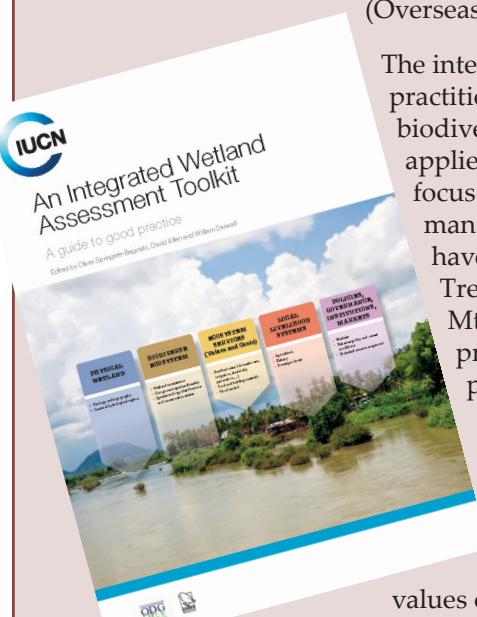
Additional information

Integrated wetland assessment: strengthening pro-poor wetland conservation using integrated biodiversity and livelihoods assessments

A key need exists among decision-makers for accessible and digestible information on the links between wetland biodiversity, economic values and livelihoods. Wetland communities are often highly dependent on wetland biodiversity, for example through the importance of fishing for essential food and income. Such communities are also particularly vulnerable to factors outside their control, since activities far upstream or downstream can affect fish populations and flooding regimes.



To help in meeting this need, a Toolkit of methodologies to assess biodiversity and the value of wetland biodiversity to livelihoods, particularly of the poorest, has been developed by the International Union for Conservation of Nature (IUCN). It results from a four-year project funded by the UK Darwin Initiative and undertaken in partnership with IUCN offices in Sri Lanka (Ecosystems and Livelihoods Group), Viet Nam, Cambodia and Tanzania, the IUCN Regional Office for Eastern and Southern Africa (ESARO), and the University of East Anglia (Overseas Development Group).



The integrated approach presented in the Toolkit enables practitioners to assess a wetland in terms of its combined biodiversity, economic and livelihood values, and it can be applied to all types of wetlands at all scales. It has a particular focus on strengthening pro-poor approaches to wetland management, and it documents how the methodologies have been put into practice through assessments in Stung Treng Ramsar Site, Lower Mekong, Cambodia and in Mtanza-Msona Village, Rufiji floodplain, Tanzania. Clear presentation of information to decision-makers is a key purpose of the Toolkit.

Following initial scoping exercises to generate broad basic data, capacity and awareness on wetland values within the focal regions, fieldwork at the two assessment sites was undertaken, and integrated reports on the livelihood, biodiversity and economic values of the areas disseminated.

The assessments have yielded detailed scientific and management information, including GIS maps and databases which document key values and overlaps between threatened species and areas of high human dependence. Information obtained through the assessments has fed in particular into the site management plan for the Stung Treng Ramsar Site, supporting pro-poor wetland conservation and sustainable use to the benefit of local livelihoods and biodiversity.

An Integrated Wetland Assessment Toolkit: a guide to good practice, published in 2009, is available for download from <http://data.iucn.org/dbtw-wpd/edocs/2009-015.pdf>, or a paper copy can be requested from IUCN's Freshwater Biodiversity Unit, 219c Huntingdon Road, CB3 0DL Cambridge, United Kingdom.

- ii) further development of the Web-based wetland inventory meta-database;
 - iii) a review of data and information needs for Ramsar Sites and other wetlands, including guidance for the description of the ecological character of wetlands, and harmonisation of the Information Sheet on Ramsar Wetlands (RIS) with the wetland inventory core data fields and the description of ecological character [(now addressed in Resolution X.14 and Ramsar Handbook 14, 4th edition, *Data and information needs*)];
 - iv) advice on delineating and mapping wetlands (in conjunction with the description of ecological character);
 - v) further consolidated guidance on detecting, reporting and responding to change in the ecological character of wetlands [(now addressed in Resolution X.16 and Ramsar Handbook 19, 4th edition, *Addressing change in wetland ecological character*)]; and
 - vi) [completing the] establishment and implementation of mechanisms for the ecological ‘outcome-oriented’ indicators of effectiveness of the implementation of the Convention and development of further such indicators.
78. In addition to these methodological developments, Resolution IX.2 also recognizes that regular assessment and reporting on the status and trends of the ecological character of Ramsar Sites and other wetlands will need to ensure that the results of national wetland inventory and assessments are made fully accessible, as is called for in Resolution VIII.6.
79. There is also a need, recognized in the work of the Millennium Ecosystem Assessment (see Finlayson, D'Cruz & Davidson. 2005. *Ecosystems and Human Well-being: Wetlands and Water. Synthesis*. World Resources Institute, Washington D.C.), for more case studies and more widespread and comprehensive assessments of the socio-economic value of wetland ecosystem benefits/services, particularly in relation to the potential conversion of wetlands to other land uses, as the basis for sound decision-making.

VII. Priorities for improving integrated wetland inventory, assessment and monitoring

80. The following practical steps for improving integrated wetland inventory, assessment and monitoring are recommended:
- i) All countries that have not yet conducted a national wetland inventory should do so, preferably using an approach that is comparable with other large-scale wetland inventories already underway or complete. These should focus on a basic data set that describes the location and size of the wetland and the major biophysical features, including variation in the areas and the water regime – see the further guidance in the Convention’s *Framework for Wetland Inventory* (Resolution VIII.6).
 - ii) Once the baseline data have been acquired and adequately stored, more management-oriented information on wetland threats and uses,

*See also Handbook
15, Wetland
inventory*

land tenure and management regimes, benefits and values should be added. When such assessment information is recorded, it should be accompanied by clear records that describe when and how the information was collected and its accuracy and reliability.

- iii) Each inventory and assessment program should contain a clear statement of its purpose and the range of information that has been collated or collected. This extends to defining the habitats being considered and the date the information was obtained or updated.
- iv) Priority should be given to improving the global inventory for wetland habitats that are currently poorly covered in most parts of the world, i.e. seagrasses, coral reefs, saltmarshes and coastal tidal flats, mangroves, arid-zone wetlands, rivers and streams, and artificial wetlands.
- v) The effectiveness of all aspects of wetland inventory and assessment should be increased through the use of a standardised framework and a generic wetland inventory core dataset (as provided in Resolution[X.15]), designed to be as flexible as possible for use in all regions of the world and to accommodate various inventory and assessment objectives.
- vi) Models for effective wetland inventory, assessment and monitoring, using appropriate remote sensing and ground techniques, should be compiled and widely disseminated. These should outline useful habitat classifications (e.g., those based initially on landform and not vegetation parameters) and methods and means of collating and storing the information, in particular Geographic Information Systems (GIS) for spatial and temporal data that could be used for monitoring purposes.
- vii) Wetland monitoring systems should build upon the information provided in wetland inventory and assessment activities. Specific monitoring should be based on a hypothesis derived from the assessment data and be contained within a suitable management structure.

Appendix

Assessment tools contained within the Integrated Framework for Wetland Inventory, Assessment and Monitoring (IF-WIAM)

Ramsar COP9 DOC. 24 Information Paper (2005)

[*Note to 4th edition Handbook:* this Appendix simply gives a faithful reproduction of the COP9 Information Paper, and apart from adjusting a few cross-references, no attempt has been made to re-write its time-specific elements or otherwise update its content.]

1. This information paper has been prepared by Working Group 1 of the Scientific and Technical Review Panel (STRP) and the Secretariat to provide supporting information on wetland assessment for [Resolution IX.1 Annex E] *An Integrated Framework for Wetland Inventory, Assessment and Monitoring (IF-WIAM)*.
2. Each assessment tool currently included in the *Integrated Framework for Wetland Inventory, Assessment and Monitoring* is briefly described here, with standard headings and references for further information. These tools have variously been approved by previous decisions of the Conference of the Contracting Parties, are being considered for approval by Ramsar COP9, or in the case of detailed methodological guidance are being prepared by the STRP for publication as *Ramsar Technical Reports*.
3. The assessment tools are:
 - A. Wetland Risk Assessment
 - B. Environmental Impact Assessment (EIA)
 - C. Strategic Environmental Assessment (SEA)
 - D. Wetland Vulnerability Assessment (VA)
 - E. Wetland Valuation
 - F. Rapid Assessment of Biodiversity

A. Wetland Risk Assessment

(derived from the Annex to Resolution VII.10)

Purpose

4. The Convention's Wetland Risk Assessment Framework provides a mechanism for predicting and assessing change in the ecological character of the sites included in the List of Wetlands of International Importance and other wetlands. It provides guidance on how to predict and assess change in the ecological character of wetlands and promotes, in particular, the usefulness of early warning systems.

Description

5. The framework comprises a standardised model for wetland risk assessment, modified from a generalised ecological risk assessment paradigm. It outlines six steps:
6. **Step 1 - Identification of the problem.** This is the process of identifying the nature of the problem and developing a plan for the remainder of the risk assessment based on this information. It defines the objectives and scope

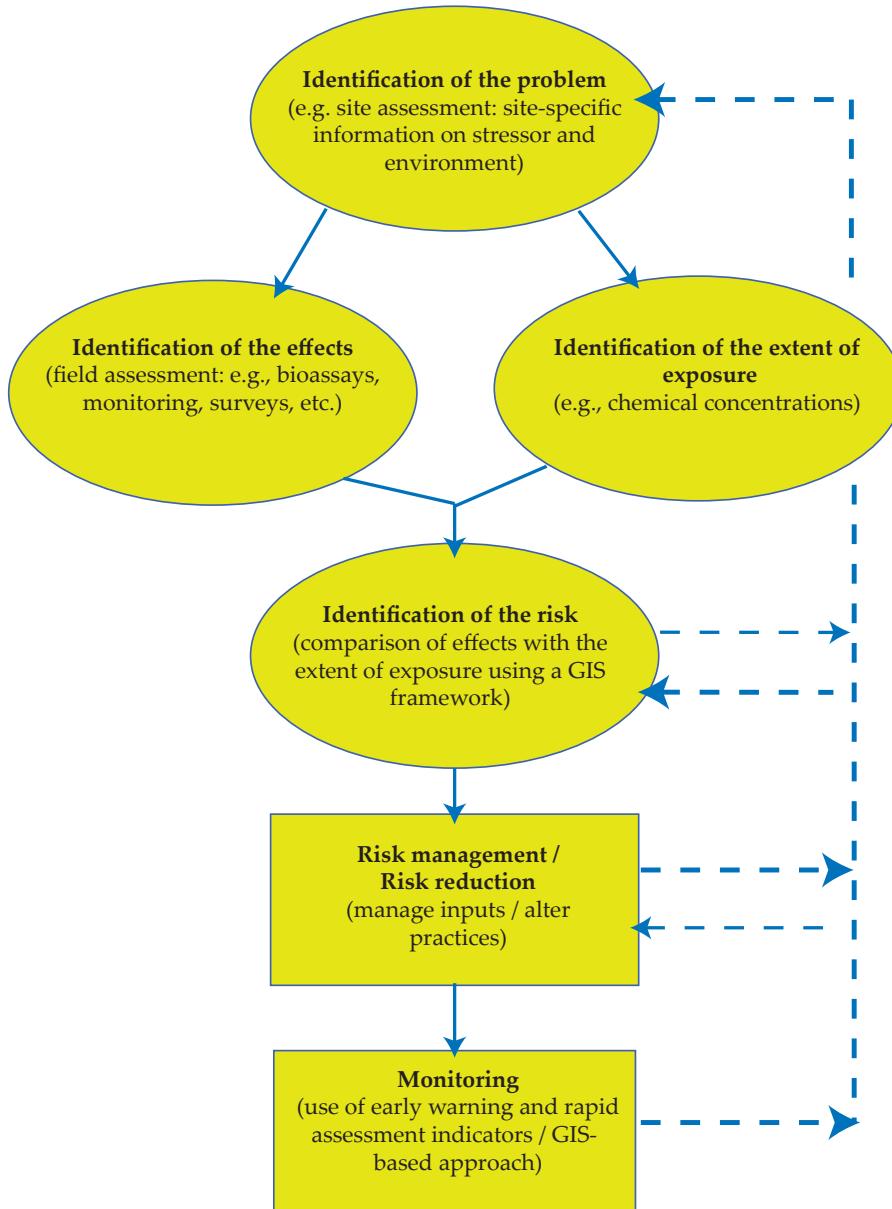
of, and provides the foundation for, the risk assessment. In the case of a chemical impact, it would include obtaining and integrating information on the characteristics (for example, properties, known toxicity) and source of the chemical, what is likely to be affected, and how is it likely to be affected, and importantly, what is to be protected.

7. **Step 2 - Identification of the adverse effects.** This step evaluates the likely extent of adverse change or impact on the wetland. Such data should preferably be derived from field studies, as field data are more appropriate for assessments of multiple impacts, such as occur on many wetlands. Depending on the extent of adverse change and available resources, such studies can range from quantitative field experiments to qualitative observational studies. For chemical impacts, on-site ecotoxicological bioassays constitute appropriate approaches, whereas for changes caused by weeds or feral animals, on-site observation and mapping may be all that is required.
8. **Step 3 - Identification of the extent of the problem.** This step estimates the likely extent of the problem on the wetland of concern by using information gathered about its behaviour and extent of occurrence elsewhere. In the case of a chemical impact, this includes information on processes such as transport, dilution, partitioning, persistence, degradation, and transformation, in addition to general chemical properties and data on rates of chemical input into the environment. In the case of an invasive weed, it might include detailed information on its entry into an ecosystem, rate of spread and habitat preferences. While field surveys most likely represent the ideal approach, use of historical records, simulation modeling, and field and/or laboratory experimental studies all represent alternative or complementary methods of characterising the extent of the problem.
9. **Step 4 - Identification of the risk.** This involves integration of the results from the assessment of the likely effects with those from the assessment of the likely extent of the problem, in order to estimate the likely level of adverse ecological change on the wetland. A range of techniques exists for estimating risks, often depending on the type and quality of the likely effects and their extent. A potentially useful technique for characterising risks in wetlands is via a GIS-based framework, whereby the results of the various assessments are overlaid onto a map of the region of interest in order to link effects to impact. In addition to estimating risks, such an approach would also serve to focus future assessments and/or monitoring on identified problem areas.
10. **Step 5 - Risk management and reduction.** This is the final decision-making process and uses the information obtained from the assessment processes described above, and it attempts to minimise the risks without compromising other societal, community or environmental values. In the context of the Ramsar Convention, risk management must also consider the concept of wise use and the potential effects of management decisions on this. The result of the risk assessment is not the only factor that risk management considers; it also takes into account political, social, economic, and engineering/technical factors, and the respective benefits and limitations of each risk-reducing action. It is a multidisciplinary task

requiring communication between site managers and experts in relevant disciplines.

11. **Step 6 - Monitoring.** Monitoring is the last step in the risk assessment process and should be undertaken to verify the effectiveness of the risk management decisions. It should incorporate components that function as a reliable early warning system, detecting the failure or poor performance of risk management decisions prior to serious environmental harm occurring. The risk assessment will be of little value if effective monitoring is not undertaken. The choice of endpoints to measure in the monitoring process is critical. Further, a GIS-based approach will most likely be a useful technique for wetland risk assessment, as it incorporates a spatial dimension that is useful for monitoring adverse impacts on wetlands.

Model for wetland risk assessment



Case studies

Invasive species

Begg, G.W., van Dam, R.A., Lowry, J.B., Finlayson, C.M. and Walden, D.J. 2001. Inventory and risk assessment of water dependent ecosystems in the Daly basin, Northern Territory, Australia. Supervising Scientist Report 162, Supervising Scientist. Darwin, Australia.

Van Dam, R.A., Walden, D. and Begg, G.W. 2002. A preliminary risk assessment of cane toads in Kakadu National Park. Supervising Scientist Report 164, Supervising Scientist Division, Darwin, Australia.

Water allocation for environmental purposes

Walden, D., van Dam, R., Finlayson, M., Storrs, M., Lowry, J. and Kriticos, D. 2004. A risk assessment of the tropical wetland weed *Mimosa pigra* in northern Australia. Supervising Scientist Report 177, Supervising Scientist, Darwin, Australia.

Ramsar source material

Resolution VII.10 on a *Wetland Risk Assessment Framework* (www.ramsar.org/pdf/res/key_res_vii.10e.pdf)

The risk assessment framework is also included in Ramsar Wise Use Handbook [18, 4th edition (www.ramsar.org/pdf/lib/hbk4-18.pdf)]

Further reading:

van Dam, R.A. and Finlayson, C.M. 2004. Developing local capacity and ensuring relevance in risk assessment for tropical wetlands. *SETAC Globe*, February 2004, 36-38.

B. Environmental Impact Assessment (EIA)

(derived from Ramsar Wise Use Handbook [16, 4th edition])

Purpose

12. Environmental impact assessment is a process of evaluating the likely environmental impacts of a proposed project or development, taking into account interrelated socio-economic, cultural and human-health impacts, both beneficial and adverse.

Description

13. Although legislation and practice vary around the world, the fundamental components of an environmental impact assessment would necessarily involve the following stages:
14. **Step 1 – Screening.** Screening to determine which projects or developments require a full or partial impact assessment study.
15. **Step 2 – Scoping.** To narrow the focus of the broad issues found to be significant during the screening stage. It is used to derive terms of reference (sometimes referred to as guidelines) for environmental impact assessment

and enables the competent authority (or environmental impact assessment professionals in countries where scoping is voluntary) to:

- guide study teams on significant issues and alternatives to be assessed, clarify how they should be examined (methods of prediction and analysis, depth of analysis) and according to which guidelines and criteria;
 - provide an opportunity for stakeholders to have their interests taken into account in the environmental impact assessment; and
 - ensure that the resulting environmental impact statement is useful to the decision maker and understandable to the public.
16. ***Step 3 - Impact analysis and assessment.*** This is an iterative process of assessing impacts, redesigning alternatives and comparison. The main tasks of impact analysis and assessment are:
- refinement of the understanding of the nature of the potential impacts identified during screening and scoping and described in the terms of reference. This includes the identification both of indirect and cumulative impacts and of the likely causes of the impacts (impact analysis and assessment). Identification and description of relevant criteria for decision-making can be an essential element of this period;
 - review and redesign of alternatives; consideration of mitigation measures; planning of impact management; evaluation of impacts; and comparison of the alternatives; and
 - reporting of study results in a environmental impact statement.
17. Assessing impacts usually involves a detailed analysis of their nature, magnitude, extent and effect, and a judgment of their significance, i.e., whether the impacts are acceptable to stakeholders, require mitigation, or are just unacceptable. Biodiversity information available is usually limited and descriptive and cannot be used as a basis for numerical predictions. There is a need to develop or compile biodiversity criteria for impact evaluation and to have measurable standards or objectives against which the significance of individual impacts can be evaluated. The priorities and targets set in the national biodiversity action plan and strategy process can provide guidance for developing these criteria. Tools will need to be developed to deal with uncertainty, including criteria on using risk assessment techniques, precautionary approach, and adaptive management.
18. ***Step 4 – Identification of mitigation measures.*** If the evaluation process concludes that the impacts are significant, the next stage in the process is to propose mitigation ideally drawn together into an “environmental management plan”. The purpose of mitigation in environmental impact assessment is to look for better ways to implement project activities so that negative impacts of the activities are avoided or reduced to acceptable levels and the environmental benefits are enhanced, and to make sure that the public or individuals do not bear costs which are greater than the benefits which accrue to them. Remedial action can take several forms, i.e. avoidance (or prevention), mitigation (including restoration and rehabilitation of sites), and compensation (often associated with residual impacts after prevention and mitigation).

19. **Step 5 – Making a decision.** Decision-making takes place throughout the process of environmental impact assessment in an incremental way, from the screening and scoping stages to decisions during data-collecting and analysis and impact prediction to making choices between alternatives and mitigation measures, and finally the decision between refusal or authorization of the project. Biodiversity issues should play a part in decision-making throughout. This final decision is essentially a political choice about whether or not the proposal is to proceed, and under what conditions. If rejected, the project can be redesigned and resubmitted. It is desirable that the proponent and the decision-making body are two different entities.
20. The precautionary approach should be applied in decision-making in cases of scientific uncertainty about risk of significant harm to biodiversity. As scientific certainty improves, decisions can be modified accordingly.
21. **Step 6 - Monitoring and evaluation.** Monitoring and auditing are used to see what actually occurs after project implementation has started. Predicted impacts on biodiversity should be monitored, as should the effectiveness of mitigation measures proposed in the environmental impact assessment. Proper environmental management should ensure that anticipated impacts are maintained within predicted levels, that unanticipated impacts are managed before they become a problem, and that the expected benefits (or positive developments) are achieved as the project proceeds. The results of monitoring provide information for periodic review and alteration of environmental management plans, and for optimising environmental protection through good practice at all stages of the project. Biodiversity data generated by environmental impact assessment should be made accessible and useable by others and should be linked to biodiversity assessment processes being designed and carried out under the Convention on Biological Diversity.
22. An environmental audit is an independent examination and assessment of a project's (past) performance, is part of the evaluation of the environmental management plan, and contributes to the enforcement of EIA approval decisions.

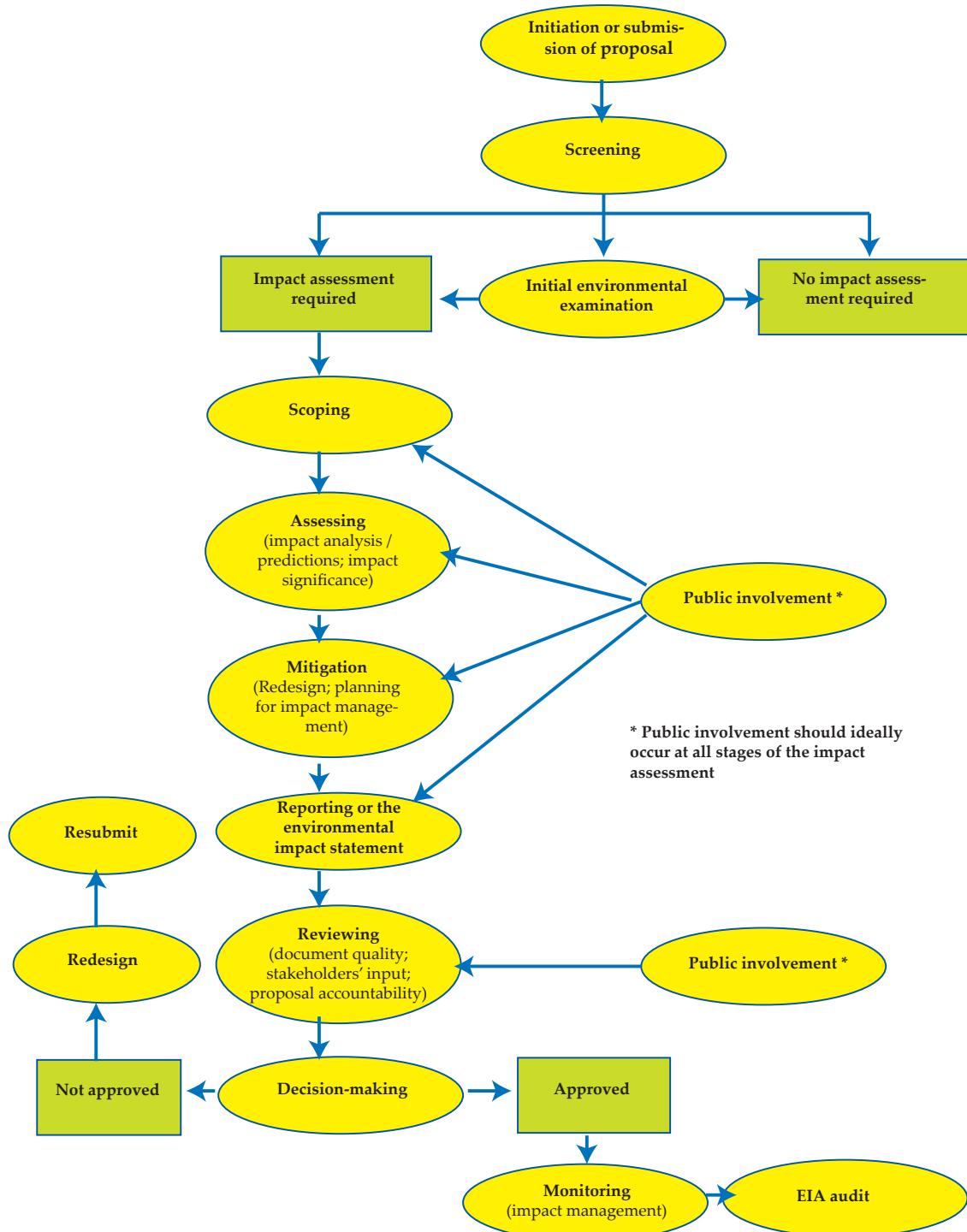
Ramsar source material

Ramsar Resolutions and Recommendations covering environmental impact assessment include:

Resolution VIII.9. *Guidelines for incorporating biodiversity-related issues into environmental impact assessment legislation and/or processes and in strategic environmental assessment' adopted by the Convention on Biological Diversity (CBD), and their relevance to the Ramsar Convention.* (www.ramsar.org/pdf/res/key_res_viii_09_e.pdf) [Annexed guidelines now superseded by the guidelines annexed to Resolution X.17];

Resolution VII.16. *The Ramsar Convention and impact assessment: strategic, environmental and social* (www.ramsar.org/pdf/res/key_res_vii.16e.pdf); and

Recommendation 6.2. *Environmental Impact Assessment* (www.ramsar.org/pdf/rec/key_rec_6.02e.pdf)



Flowchart of key steps in the environmental impact assessment procedure
(from UNEP/CBD/SBSTTA/7/13 and Ramsar Wise Use Handbook [16])

The guidance on environmental impact assessment is covered by Ramsar Wise Use Handbook [16] *Impact Assessment*, 4th edition (www.ramsar.org/pdf/lib/hbk4-16.pdf).

Further reading

- Nooteboom, S. 1999. *Environmental assessments of strategic decisions and project decisions: interactions and benefits*. Ministry of Housing, Spatial Planning and the Environment of the Netherlands.
- Treweek, J. 2001. *Biodiversity in development. Biodiversity and EIA for development cooperation: workshop conclusions*. EC/EU Tropical Biodiversity Advisors' Group, EU, DFID and IUCN.
- International Association for Impact Assessment. 2005. Biodiversity in Impact Assessment. IAIA Special Publication Series No. 3.

C. Strategic Environmental Assessment (SEA) (derived from Ramsar Wise Use Handbook [16])

Purpose

23. Strategic environmental assessment is the formalized, systematic and comprehensive process of identifying and evaluating the environmental consequences of proposed policies, plans or programmes to ensure that they are fully included and appropriately addressed at the earliest possible stage of decision-making on a par with economic and social considerations. Strategic environmental assessment, by its nature, covers a wider range of activities or a wider area and often over a longer time span than the environmental impact assessment of projects.
24. Strategic environmental assessment might be applied to an entire sector (such as a national policy on energy, for example) or to a geographical area (for example in the context of a regional development scheme).

Description

25. The basic steps of strategic environmental assessment are similar to the steps in environmental impact assessment procedures, but the scope differs. Strategic environmental assessment does not replace or reduce the need for project-level environmental impact assessment, but it can help to streamline the incorporation of environmental concerns (including biodiversity) into the decision-making process, often making project-level environmental impact assessment a more effective process. Strategic Environmental Assessment is designed to assess the potential impacts of policies, plans or programmes generally at national level.
26. This is done through the following steps:

Step 1 – Initiation. Determine if there is a need for an Assessment.

Step 2 – Reviewing. Assess the relationship between the plan-proposal and other relevant policies, plans and programs of activity.

Step 3 - Scoping. Identify alternatives and impacts to be assessed.

Step 4 - Impact assessment. Assess the evidence and predict environmental outcomes associated with alternatives being considered.

Step 5 - Outside review. Seek input and advice from others, including other government agencies, independent experts, interest groups, and the public.

- Step 6 – Documentation.** Collect and present the information for reporting and further use as necessary.
- Step 7 – Decision.** Outline the outcome and initial thinking on impact assessment.
- Step 8 – Identification.** Identify information and monitoring requirements for project-level Environmental Impact Assessment.
- Step 9 - Follow-up.** What is required next, including implementation of mitigation ahead of project-level impact.
27. Strategic Environmental Assessment has developed at a slower pace than Environmental Impact Assessment and is only now starting to form around a consolidated and consistent approach. Public participation and consultation is included throughout the Strategic Environmental Assessment process and is required by law in some jurisdictions. Strategic Environmental Assessment is thus a process for decision-makers to review the environmental objectives and implications of their proposals and to ensure that they are compatible with other policies and planned initiatives. Plan-makers may be local authorities, government agencies and ministries, or other formal authorities and agencies responsible for policy-making and planning. In many jurisdictions, Strategic Environmental Assessment is more explicitly intended as a tool for promoting sustainable development. It offers support in the Ramsar context to implementation of the wise use concept, and to integrated water and wetland resources management.

Ramsar source material

28. Ramsar Resolutions and Recommendations covering environmental impact assessment include:

Resolution VIII.9. Guidelines for incorporating biodiversity-related issues into environmental impact assessment legislation and/or processes and in strategic environmental assessment' adopted by the Convention on Biological Diversity (CBD), and their relevance to the Ramsar Convention (www.ramsar.org/pdf/res/key_res_viii_09_e.pdf) [Annexed guidelines now superseded by the guidelines annexed to Resolution X.17];

Resolution VII.16. The Ramsar Convention and impact assessment: strategic, environmental and social (www.ramsar.org/pdf/res/key_res_vii.16e.pdf), and Recommendation 6.2 Environmental Impact Assessment (www.ramsar.org/pdf/rec/key_rec_6.02e.pdf);

The guidance on strategic environmental assessment covered in Ramsar Wise Use Handbook [16] *Impact Assessment*, [4th edition] (www.ramsar.org/pdf/lib/hbk4-16) is [drawn partly] from "The Ramsar Convention and Impact Assessment (Athanas, A. & Vorhies, F.) 1999. Ramsar COP7 Technical Session IV (full text at www.ramsar.org/cda/en/ramsar-documents-cops-cop7-ramsar-cop7-doc-19-1/main/ramsar/1-31-58-83%5E18715_4000_0_.pdf).

Further reading

Sadler, B. and R. Verheem 1996. *Strategic Environmental Assessment. Status, challenges and future directions*. Ministry of Housing, Spatial Planning and Environment, The Hague, The Netherlands.

South Africa 2000. *Strategic Environmental Assessment in South Africa. Guideline document*. Department of Environmental Affairs and Tourism, Pretoria, South Africa.

D. Wetland Vulnerability Assessment (VA)
(from *Ramsar Technical Report*, in preparation)

Purpose

29. Vulnerability assessment determines the extent to which a wetland is susceptible to, or unable to cope with, adverse effects of climate change and variability and other pressures, such as changes in land use and cover, water regime, or over-harvesting and over-exploitation, and invasion by alien species. These pressures can act individually, cumulatively or synergistically.

Description

30. Vulnerability is determined at specific spatial and temporal scales and is a dynamic property as it changes depending on the local conditions, e.g., a system can be vulnerable at a particular time but may not be at other times (e.g., vulnerability to fire increases during dry seasons). Wetlands are vulnerable if they have low adaptive capacity and are highly vulnerable if they have low inherent capacity to cope with change, and/or there are few or no options to reduce impacts of pressures, and/or they are naturally sensitive to pressures (for example, due to their geographic location or socio-political situation). Vulnerability incorporates risk assessment (i.e., the extent of and exposure to a hazard) and is linked to the stability or resilience and sensitivity of a wetland, as well as capacity to cope with one or more hazards (Table 1).

Table 1: Relationship between sensitivity, resilience and vulnerability of a wetland

		Resilience	
		High	Low
Sensitivity			
High	Vulnerable	Very vulnerable	
Low	Not vulnerable	Vulnerable	

31. The following characteristics apply to the concept of vulnerability assessment of wetlands:
- it is forward-looking and assesses the probability of a change in the condition of a wetland in the future relative to some benchmark (or baseline);
 - the change is caused by some risky event;
 - it depends on a time horizon (i.e., the vulnerability can change depending on whether it is considered on a seasonal, annual or decadal basis); and
 - the present condition of the system, its resiliency and sensitivity determine the future vulnerability.
32. Vulnerability assessment is a process and includes determination of the probability of a risky event occurring, the effect of this on the wetland, given

its sensitivity and resilience, development of risk reduction and management options to reduce adverse impacts, formulation of a desired outcome for the wetland, and monitoring and adaptive management to ensure that the response options achieve the desired outcome.

33. The framework below draws from the OECD state-pressure-impact-response model and the Millennium Ecosystem Assessment conceptual framework, as well as the case studies cited. The framework for vulnerability assessment includes:

34. ***Step 1 - Risk assessment & Risk perception***

- Delimiting the boundaries of the social and biophysical system (the wetland and connected landscapes) to be considered and explicitly including spatial, temporal limits.
- Identification of past and present drivers of change and existing hazards.
- Assessing the present condition and recent trends in the ecological character of the wetland (using metrics such as indicator species, functional groups, etc.).
- Carrying out a stakeholders analysis – the people involved in evaluating the potential responses and also affected by the potential changes in the system.
- Determining the sensitivity and resilience including adaptive capacity of the wetland.
- Identifying the wetland and groups of people that are particularly sensitive to different pressures.
- Developing scenarios and storylines with the involvement of the stakeholders to the risk of possible drivers of change and the interaction between them that could lead to future changes.

35. ***Step 2 - Risk minimisation or management***

- Identifying the wetland components and groups of people that would not have the ability to cope with the changes, often adverse, given their low present adaptive capacity and/or sensitivity.
- Developing response options that can minimise the risk of abrupt and/or large changes in the ecological character of the wetland (and thus maintaining the ecosystem services provided for people). In some cases, given the adaptive capacity, sensitivity and resilience of the wetland, no further management response may be needed.
- Trade-off analysis to choose between potential response options and overcome constraints, such as institutional capacity and capability, information/data availability, and political and governance requirements.
- Specifying the desired outcomes for the system as determined from an agreed baseline or reference condition, and taking into account the dynamic nature of many wetlands.

36. ***Step 3 - Monitoring and adaptive management***

- Incorporate monitoring throughout the steps in the framework and through structured analysis and learning from the results of the monitoring adapt management responses accordingly. This entails

outlining the path most likely to procure the desired outcomes, and measuring indicators of success or otherwise.

Case studies

Bayliss, B., Brennan, K., Eliot, J., Finlayson, M., Hall, R., House, T., Pidgeon, B., Walden, D. and Waterman, P., 1997. *Vulnerability assessment of predicted climate change and sea level rise in the Alligator Rivers Region, Northern Territory Australia*. Supervising Scientist Report 123, Supervising Scientist, Canberra, Australia.

Sharma, M., I. Burton, M. van Aalst, M. Dilley, and G. Acharya 2000. *Reducing Vulnerability to Environmental Variability: Background Paper for the Bank's Environmental Strategy*. The World Bank, Washington, D.C., USA.

van Dam, R.A., Finlayson, C.M. and Watkins, D. (eds) 1999. *Vulnerability Assessment of Two Major Wetlands in The Asia-Pacific Region to Climate Change and Sea Level Rise*. Supervising Scientist Report 149, Darwin, Australia. 161 pp.

Ramsar source material

Gitay, H. in prep. Guidance on vulnerability assessment of wetlands to change in ecological character. *Ramsar Technical Report*. Ramsar Convention Secretariat, Gland, Switzerland.

Further reading

Millennium Ecosystem Assessment. 2003. *Ecosystems and Human Well-being: A Framework for Assessment*. Island Press, Washington, D.C., 245 pp.

Downing, T. and Dougherty, B., 2004. *Toward a core methodology for climate vulnerability and adaptation*. Stockholm Environment Institute, www.vulnerabilitynet.org

E. Wetland Valuation (Valuation of Wetland Services)

(from *Ramsar Technical Report 3*)

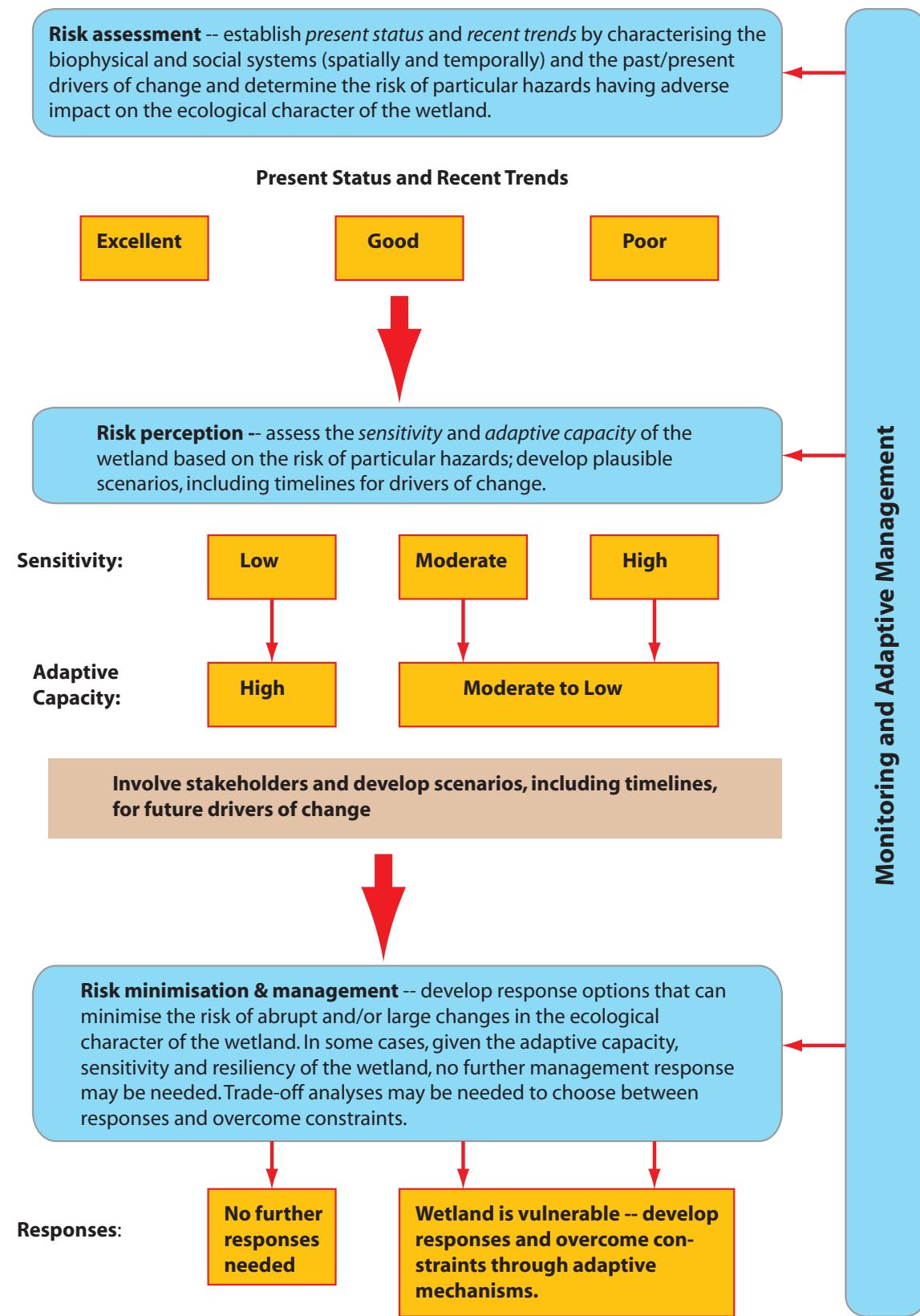
Purpose

37. Valuation provides information on the value (importance) of wetlands and their services to different stakeholders, so as to ensure that balanced decision-making occurs about competing uses of wetlands. Such information has often not fully been taken into account in the past when making decisions about economic development. Valuation has been defined by the *Millennium Ecosystem Assessment* as "The process of expressing a value for a particular good or service . . . in terms of something that can be counted, often money, but also through methods and measures from other disciplines (sociology, ecology and so on)".

Description

38. The five main steps in undertaking valuation of wetlands are:
39. **Step 1 - Analysis of policy processes and management objectives.** Provide insight into the policy processes and management objectives to set the stage for a discussion about the kind of valuation needed (e.g., to assess the

A framework for wetland vulnerability assessment (from Gitay in prep., Ramsar Technical Report)



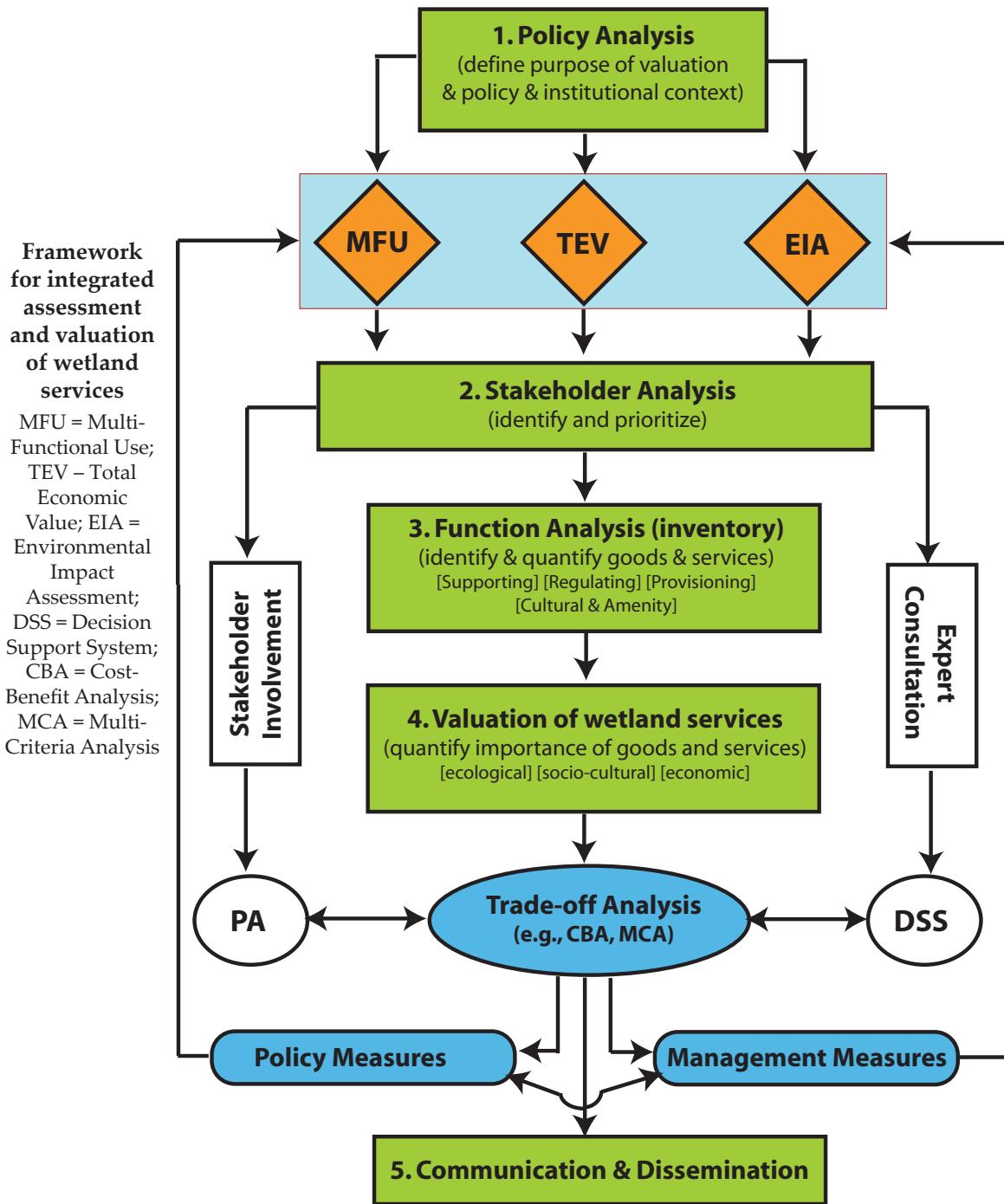
impact of past or ongoing interventions, or to analyse trade-offs of planned wetland uses (= partial valuation) or to determine the Total Value of the intact wetland). During this step it should be ascertained how values that are relevant to policy and management decisions can be generated.

40. **Step 2 - Stakeholder analysis and involvement.** The main stakeholders should be identified, as the involvement of stakeholders is essential in almost all steps of the valuation procedure: i.e., to determine the main policy and management objectives, to identify the main relevant services and assess their value, and to discuss trade-offs involved in wetland use.
41. **Step 3 - Function analysis (quantification of services) (what should be valued?).** The wetland characteristics (processes and components) are translated into functions which provide specific services. These services should be quantified in appropriate units (biophysical or otherwise), based on actual or potential sustainable use levels.
42. **Step 4 - Valuation of services (how to undertake the valuation ?).** In this step, the benefits derived from the wetland services identified in step 3 are analysed. These benefits should be quantified in both the appropriate value-units (ecological, socio-cultural and economic indicators) as well as monetary values.
43. **Step 5 - Communicating wetland values.** To make the results of the valuation fully accessible to all the stakeholders and relevant decision-makers, communication and dissemination activities are essential. On-line support to these guidelines is provided through [<http://topshare.wur.nl/naturevaluation>], which gives access to existing data bases, literature and case studies, and discussion platforms for exchange of information and experiences on valuation of wetland functions.
44. Although the valuation itself finishes with this last step, it is crucial that the information generated by the valuation is structurally integrated into decision-making instruments such as multi-criteria analysis and cost-benefit analysis (see figure below). However, this is beyond the scope of the guidelines for undertaking the valuation itself.

Case studies

- Emerton, L., & Bos, E. 2004. *Value. Counting Ecosystems as an Economic Part of Water Infrastructure*. IUCN, Gland, Switzerland and Cambridge, UK.
- IIED, 1997. *Valuing the Hidden Harvest : Methodological approaches for local-level economic analysis of wild resources*. Sustainable Agriculture Research Series Volume 3, Number 4. Sustainable Agriculture Programme, IIED, London.
- Stuip, M.A.M, Baker,C.J., and Oosterberg, W., 2002. *The Socio-economics of Wetlands*. Wetlands International and Riza, Wageningen, The Netherlands (35 pp).
- Wilson, M.A. and S.R. Carpenter, 1999: *Economic Valuation of Freshwater Ecosystem Services in the United States 1971-1997*, Ecological Applications 9(3): 772-783.

Ramsar source material



de Groot, R., Stuip, M., Finlayson, C.M. & Davidson, N.C. 2006. Waluing wetlands. Guidelines for valuing the benefits derived from wetland ecosystem services. *Ramsar Technical Report No. 3/CBD Technical Series No. 27*. Ramsar Convention Secretariat, Gland, Switzerland & Secretariat of the Convention on Biological Diversity, Montreal, Canada.

Some brief guidance on economic valuation of wetlands is also included in Ramsar Wise Use Handbook [16] *Impact Assessment* ([4th edition]) (www.ramsar.org/pdf/lib/hbk4-16.pdf)

Further reading (see also [<http://topshare.wur.nl/naturevaluation>] for further sources and case studies)

Balmford,A., A.Bruner, P.Cooper, R.Costanza, S.Farber, R.E.Green, M.Jenkins, P.Jefferiss, V.Jessamy, J.Madden, K.Munro, N.Myers, S.Naeem, J.Paavola, M. Rayment, S.Rosendo, J.Roughgarden, K.Trumper and R.K.Turner, 2002. Economic Reasons for Conserving Wild Nature. *Science* Vol. 297:950-953.

Barbier, E.B., M.C. Acreman and D. Knowler, 1996: *Economic valuation of wetlands; a guide for policy makers and planners*. Ramsar Convention Bureau, Gland, Switzerland.

Costanza,R., R.d'Arge, R.S.de Groot, et al., 1997. The Total Value of the World's Ecosystem Services and Natural Capital. *Nature* Vol 387:253-260.

de Groot, R.S., 1992. *Functions of Nature: evaluation of nature in environmental planning, management and decision-making*. Wolters Noordhoff BV, Groningen, the Netherlands (345 pp).

Emerton, L., & Bos, E. 2004. *Value. Counting Ecosystems as an Economic Part of Water Infrastructure*. IUCN, Gland, Switzerland and Cambridge, UK.

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F. Rapid Assessment of Biodiversity

(derived from [Resolution IX.1 Annex E i and Ramsar Technical Report 1])

Purpose

45. Rapid assessment is a synoptic assessment of the species biodiversity of a wetland. It is often undertaken as a matter of urgency, in the shortest timeframe possible to produce reliable and applicable results.
46. Rapid assessment methods for wetlands are not generally designed to take into account temporal variance, such as seasonality, in ecosystems. However, some rapid assessment methods can be used in repeat surveys as elements of an integrated monitoring programme to address such temporal variance.

Description

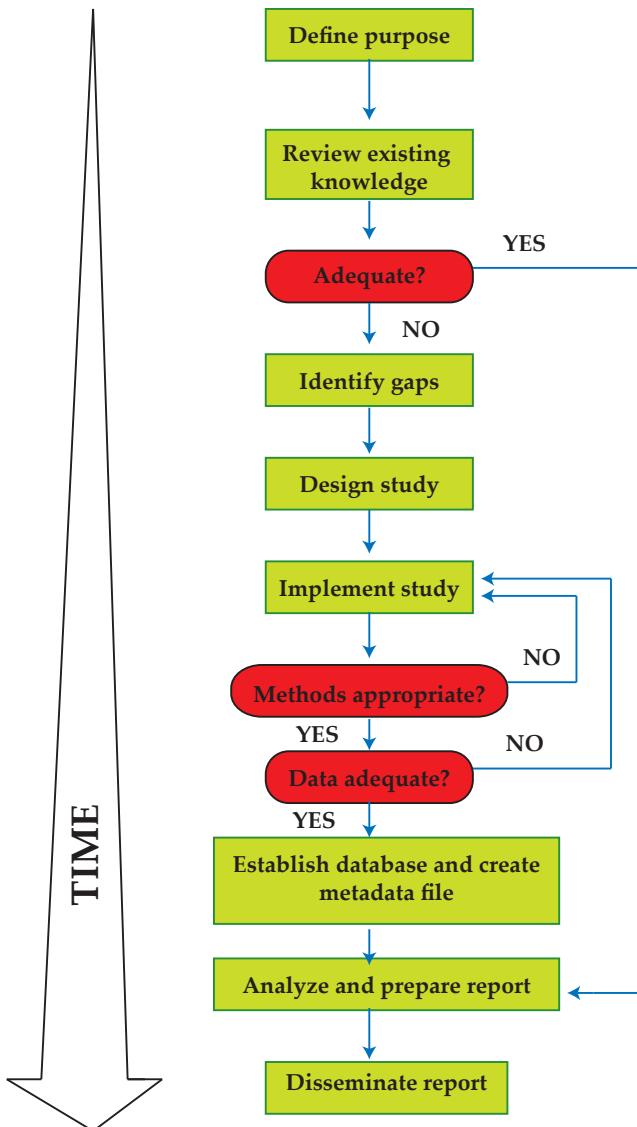
47. Rapid assessment techniques are particularly relevant to the species level of the components of biological diversity. Other rapid assessment methods, including remote sensing techniques, can be applicable to the ecosystem/wetland habitat level, particularly for rapid inventory assessments, and it may be appropriate to develop further guidance on ecosystem-level rapid assessment methods. Assessments of the genetic level of biological diversity do not generally lend themselves to "rapid" approaches.
48. The guidelines for Rapid Assessments, developed jointly by the Convention on Biological Diversity and the Ramsar Convention, stress the importance of

clearly establishing the purpose as the basis for design and implementation of the assessment. They also emphasize that before deciding on whether a new field survey using rapid assessment methods is necessary, a thorough review of existing knowledge and information should be undertaken, including information held by local communities. Subsequent steps are then presented in the form of a decision tree to facilitate the selection of appropriate methods to meet the purpose of the assessment. An indication of the categories of information which can be acquired through each of the rapid assessment methods is provided. Summary information on a range of appropriate and available methods suitable for each rapid assessment purpose is included, as is information on a range of different data analysis tools.

49. ***Step 1 – State the purpose and objective.*** State the reason(s) for undertaking the rapid assessment: why the information is required and by whom it is required. This will include determining the scale and resolution required to achieve the purpose and objective, subsequent identification of the core or minimum data sufficient to describe the location and size, and any special features of the wetland.
50. ***Step 2 - Review existing knowledge and information – identify gaps.*** Review available information sources and local knowledge (including scientists, stakeholders, and local and indigenous communities), using desk studies, workshops, etc., so as to determine the extent of knowledge and information available for inland water biodiversity in the region being considered. Include all available data sources
51. ***Step 3 - Study design.*** This includes a number of discrete components:
 - a) **Review existing assessment methods, and choose appropriate method.** Review available methods, and seek expert technical advice as needed, to choose the methods that can supply the required information. A decision tree is available for assisting in the choice of appropriate field survey methods.
 - b) **Establish a habitat classification system where needed.** Choose a habitat classification that suits the purpose of the assessment, since there is no single classification that has been globally accepted.
 - c) **Establish a time schedule.** A time schedule is required for i) planning the assessment; ii) collecting, processing and interpreting the data collected; and iii) reporting the results.
 - d) **Establish the level of resources required, assess the feasibility and cost-effectiveness that are required.** Establish the extent and reliability of the resources available for the assessment and make contingency plans to ensure that data are not lost due to insufficiency of resources. Assess whether or not the programme, including reporting of the results, can be undertaken under the current institutional, financial and staff situation. Determine if the costs of data acquisition and analysis are within budget and that a budget is available for the programme to be completed. Where appropriate, plan a regular review of the programme.

- e) **Establish a data management system and a specimen curation system.** Establish clear protocols for collecting, recording and storing data, including archiving in electronic or hardcopy formats. Ensure adequate specimen curation to enable future users to determine the source of the data, and its accuracy and reliability, and to access reference collections. At this stage it is also necessary to identify suitable data analysis methods. All data analysis should be done by rigorous and tested methods and all information documented. The data management system should support, rather than constrain, the data analysis, and should include a meta-database to: i) record information about the inventory datasets and ii) outline details of data custodianship and access by other users.
 - f) **Establish a reporting procedure.** Establish a procedure for interpreting and reporting all results in a timely and cost effective manner. The reporting should be succinct and concise, indicate whether or not the objective has been achieved, and contain recommendations for biodiversity management action, including whether further data or information is required.
 - g) **Establish a review and evaluation process.** Establish a formal and open review process to ensure the effectiveness of all procedures, including reporting and, when required, supply information to adjust the assessment process.
52. **Step 4 - Perform study and include continuous assessment of methodology.** Undertake the assessment and ensure that it is tested and adjusted as necessary. Details of all methods and changes in the method, including specialist equipment being used, should be recorded. The training needs of staff involved should be assessed and steps taken to provide them with the necessary skills. The means of collating, collecting, entering, analysing and interpreting the data should also be confirmed and documented. In particular, ensure that any remote sensing can be supported by appropriate "ground-truth" survey.
53. **Step 5 - Data assessment and reporting.** Establish a formal and open review process to ensure the effectiveness of all procedures, including reporting and, when required, supply information to adjust or even terminate the program. Results should be provided in appropriate styles and level of detail to local authorities, local communities and other stakeholders, local and national decision-makers, donors and the scientific community. If the purpose of the assessment was not achieved it is necessary to return to Step 3 above.
54. A decision tree is available to enable the selection of appropriate biodiversity assessment methods, based on a structured framework of selection criteria. These are organized in a progression of the most important factors of biodiversity assessment of wetlands. The tree begins with the most basic and broad elements of an assessment, and it advances through progressively more selective criteria. Eventually a general framework of the necessary assessment should emerge, taking the amalgamated form defined by its purpose, output information, available resources, and scope. The idea is to meld informational parameters, like output and purpose, with logistical parameters such as time frame, available funding, and geographical scope,

Summary of key steps in applying the CBD/Ramsar conceptual framework for rapid assessment



in order to present a realistic assessment model and determine what methods are available for its implementation.

55. The decision tree provides three general purposes corresponding to five specific purposes, which will determine the assessment type. The five specific **assessment types** used in the decision tree are: *inventory assessment, specific-species assessment, impact assessment, indicator assessment, economic resource assessment*. Once the purpose and assessment type have been determined, the decision tree leads users through a matrix of more specific components of a biological diversity assessment.

Case studies

De Pauw N. & Hawkes H.A.. 1993. Biological monitoring of river water quality. *Proc. Freshwater Europe Symp. on River Water Quality Monitoring and Control.* Aston University, Birmingham. p. 87-111.

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- Metcalfe J.L. 1989. Biological Water Quality Assessment of running Waters Based on Macroinvertebrate Communities: History and Present Status in Europe. *Environmental Pollution* 60 (1989): 101-139.
- Raven P.J., Holmes N.T.H., Dawson F.H., Fox P.J.A., Everard M., Fozzard I.R. & Rouen K.J.. 1998. River Habitat Quality – the physical character of rivers and streams in the UK and Isle of Man. River Habitat Survey, Report No. 2. Environment Agency, Scottish Environment Protection & Environment and Heritage Service. 86 p.
- Prati L., Pavanello R. & Pesarin F. 1971. Assessment of surface water quality by a single index of pollution. *Water Research* 5: 741-751.

Ramsar source material

Resolution IX.1 Annex E i. *Guidelines for the rapid assessment of inland, coastal and marine wetland biodiversity*. Now published as CBD Technical Series No. 22/ Ramsar Technical Report 1. 2006. Available on: [www.ramsar.org/pdf/lib/lib_rtr01.pdf]

Some guidance on rapid assessment of biodiversity is also provided in Ramsar Wise Use Handbook [18] *Managing Wetlands* ([4th edition]) (www.ramsar.org/pdf/lib/hbk4-18.pdf).

Further reading

- Groves, C. R., Jensen, D.B., Valutis, L.L., Redford, K.H., Shaffer, M.L., Scott, J.M., Baumgartner, J.V., Higgins, J.V., Beck, M.W., and M.G. Anderson. 2002. Planning for biodiversity conservation: putting conservation science into practice. *BioScience* 52(6):499-512.
- Hollowell, J.M.. 1986. *Biological indicators of freshwater pollution and environmental management*. Pollution Monitoring Series. Elsevier Applied Science. 546 p.
- Magurran, A.E. 1988. *Ecological diversity and its measurement*. Princeton University Press, New Jersey, USA.
- Washington, H.G..1984. Diversity, biotic and similarity indices. A review with special relevance to aquatic ecosystems. *Water Research* 18: 653-694.
- Persoone, G. & De Pauw, N.. 1979. Systems of Biological Indicators for Water Quality Assessment. In: Ravera O. *Biological Aspects of Freshwater Pollution*. Commission of the European Communities. Pergamon Press.

Relevant Resolution

Resolution IX.1

(adopted by the 9th meeting of the Conference of the Contracting Parties, Kampala, Uganda, 2005)

Additional scientific and technical guidance for implementing the Ramsar wise use concept

1. AWARE of the suite of technical and scientific guidelines and other materials prepared by the Scientific and Technical Review Panel (STRP) to support Contracting Parties in their implementation of wetland conservation and wise use;
2. NOTING that the 8th Meeting of the Conference of the Contracting Parties (COP8) instructed the STRP to prepare further advice and guidance for consideration by Contracting Parties at COP9 on topics including, *inter alia*, inventory and assessment, wise use, water resource management, Ramsar Site designation and management, and assessing the effectiveness of the implementation of the Convention;
3. THANKING the STRP for its work in preparing the advice and guidance annexed to this Resolution, as well as for the supporting technical reviews and reports being made available to Contracting Parties and others as *Ramsar Technical Reports*; and
4. ALSO THANKING the Government of Sweden and IUCN, WWF, the World Fish Centre, and the Water Research Commission (South Africa), which have provided financial support to the Panel and its Working Groups for the preparation of this advice and guidance and technical reports, and EXPRESSING GREAT APPRECIATION to the many organizations that have provided significant in-kind support to the work of the Panel;

THE CONFERENCE OF THE CONTRACTING PARTIES

5. APPROVES the *Conceptual Framework for the wise use of wetlands and the maintenance of their ecological character* (Annex A to this Resolution) and its updated definitions of "wise use" and "ecological character", and CONFIRMS that these supersede all previous definitions of these terms;
6. ALSO APPROVES the revised *Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance* (Annex B to this Resolution), INSTRUCTS the Ramsar Secretariat to introduce these changes in the preparation of a new edition of Ramsar Wise Use Handbook 7, including revisions to the Information Sheet on Ramsar Wetlands (RIS), and URGES all Contracting Parties preparing a RIS for the designation of a new site for the Ramsar List and for updating the RIS for an existing site to submit the information to the Ramsar Secretariat in this revised format;
7. WELCOMES the frameworks, guidelines and other advice provided as annexes C, D, and E to this Resolution and URGES Contracting Parties to make good use of them as appropriate, adapting them as necessary to suit national conditions and circumstances and within the frameworks of existing regional initiatives and commitments and in the context of sustainable development;
8. URGES Contracting Parties to draw these frameworks, guidelines and other advice to the attention of all relevant stakeholders, including *inter alia* government ministries, departments and agencies, water and basin management authorities, non-governmental organizations, and civil society; and FURTHER URGES Contracting Parties to encourage these stakeholders to take these guidelines into account, together with those of the Ramsar 'Toolkit' of Wise Use

Ramsar handbooks for the wise use of wetlands, 4th edition

Handbooks 2nd edition, in their decision-making and activities which relate to the delivery of the wise use of wetlands through the maintenance of their ecological character; and

9. INSTRUCTS the Ramsar Secretariat to disseminate widely the frameworks and guidelines annexed to this Resolution, including through amendment and updating of the Ramsar 'Toolkit' of Wise Use Handbooks.



World Wetlands Day in Portugal. Photo: Instituto da Conservação da Natureza

The Ramsar Convention 'toolkit' for the conservation and wise use of wetlands, 4 th ed. (2010)	
Convention pillar 1: Wise Use	
Handbook 1	Wise use of wetlands Concepts and approaches for the wise use of wetlands
Handbook 2	National Wetland Policies Developing and implementing National Wetland Policies
Handbook 3	Laws and institutions Reviewing laws and institutions to promote the conservation and wise use of wetlands
Handbook 4	Avian influenza and wetlands Guidance on control of and responses to highly pathogenic avian influenza
Handbook 5	Partnerships Key partnerships for implementation of the Ramsar Convention
Handbook 6	Wetland CEPA The Convention's Programme on communication, education, participation, and public awareness (CEPA) 2009-2015
Handbook 7	Participatory skills Establishing and strengthening local communities' and indigenous people's participation in the management of wetlands
Handbook 8	Water-related guidance An Integrated Framework for the Convention's water-related guidance
Handbook 9	River basin management Integrating wetland conservation and wise use into river basin management
Handbook 10	Water allocation and management Guidelines for the allocation and management of water for maintaining the ecological functions of wetlands
Handbook 11	Managing groundwater Managing groundwater to maintain wetland ecological character
Handbook 12	Coastal management Wetland issues in Integrated Coastal Zone Management
Handbook 13	Inventory, assessment, and monitoring An Integrated Framework for wetland inventory, assessment, and monitoring
Handbook 14	Data and information needs A Framework for Ramsar data and information needs
Handbook 15	Wetland inventory A Ramsar framework for wetland inventory and ecological character description
Handbook 16	Impact assessment Guidelines on biodiversity-inclusive environmental impact assessment and strategic environmental assessment
Convention pillar 2: Ramsar sites designation and management	
Handbook 17	Designating Ramsar Sites Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance
Handbook 18	Managing wetlands Frameworks for managing Ramsar Sites and other wetlands
Handbook 19	Addressing change in wetland ecological character
Convention pillar 3: International cooperation	
Handbook 20	International cooperation Guidelines and other support for international cooperation under the Ramsar Convention on Wetlands
Companion document	
Handbook 21	The Ramsar Convention Strategic Plan 2009-2015 Goals, strategies, and expectations for the Ramsar Convention's implementation for the period 2009 to 2015

Ramsar
Handbooks
4th edition

Handbook 13

Inventory, assessment, and monitoring



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