

**"Wetlands: water, life, and culture"
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to the Convention on Wetlands (Ramsar, Iran, 1971)
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Information Paper
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A framework for integrated wetland inventory, assessment and monitoring

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, and their use through management planning processes to maintain and enhance the ecological character of Ramsar sites and other wetlands.
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 COP7 (Costa Rica, 1999) have been incorporated into Ramsar Wise Use Handbooks 7 and 8. Several further relevant guidance documents will be considered by COP8 (Spain, 2002) for adoption.
3. However, a review in 2001 by the Convention's Scientific and Technical Review Panel (STRP) of this available guidance identified that:
 - i) there remain gaps in the existing guidance in relation to the overall implementation under the Convention process of inventory, assessment and monitoring;
 - ii) there appear to be some inconsistencies and disharmonies between the different guidances available to Parties, which have arisen from their separate development at different times in the Convention's life;
 - iii) there is insufficient clarification in the existing guidance as to the purposes and importance of applying the inventory, assessment and monitoring procedures to better deliver conservation and sustainable utilization of wetlands, and in the use of these mechanisms to raise awareness of the values and functions of wetland ecosystems; and
 - iv) there is a need to establish an overall unifying conceptual framework for wetland ecosystem assessment and for responding to its findings, under which the more specific guidance available on different aspects of the process can be more effectively applied.

4. The framework outlined in this paper has been prepared by the STRP's Expert Working Group on Ecological Character. It provides a rationale for applying the mechanisms of the Convention for inventory, assessment and monitoring so as 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 recognises some key topics requiring further guidance and elaboration under the Convention to support full implementation of the framework.

Why is identifying, assessing and reporting the status of Ramsar sites and other wetlands important?

5. 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 reduction in existing threats and appearance of new threats (monitoring); and
 - d) taking management actions (both *in situ* and *ex situ*) to redress any such changes causing or likely to cause damaging change in ecological character (management).
6. At the site scale, the Convention's guidance on management planning, including the *New Guidelines for management planning for Ramsar sites and other wetlands* under consideration by this meeting of the Conference of the Parties, 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 to maintain the wetland in a favourable conservation status.
7. At larger scales, an understanding of the status and trends at national and international scales has been recognised through the Convention as an essential basis for the establishment of national and international policies, strategies and priorities for actions to assure the conservation and wise use of wetlands.
8. Monitoring and reporting the conservation status of designated Ramsar sites should also provide an important 'health check' of the success of the Ramsar Convention as an international treaty and its mechanisms for achieving wetland conservation and wise use.
9. The use and value of the coherent national and international network of Ramsar sites called for in the *Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance* (Resolution VII.11) for assessing the status and trends of global wetlands is explicit in Objective 4.1 of the *Strategic Framework*: "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."
10. However, there is no guidance yet provided to Parties on how, and to whom, such information should be reported, although it does relate directly to the provisions of Article

3.2 of the Convention (see Ramsar COP8 DOC. xx for further discussion of the application of Article 3.2 through existing Convention mechanisms).

Gaps in available information

11. A number of studies have attempted to draw together available information on the distribution, status and trends of wetland ecosystems and all have shown substantial gaps in available information.
12. For example, the *Global Review of Wetland Resources and Priorities for Wetland Inventory*, undertaken for the Convention in 1999, found that only 7% of countries had adequate national wetland inventory, and 25% of countries had no available national wetland inventory.
13. The *Pilot Assessments of Global Ecosystems (PAGE)* for freshwater and marine and coastal ecosystems, compiled by the World Resources Institute (WRI) for the Millennium Ecosystem Assessment, likewise found that, whilst assessments exist for some wetland habitat types, in general such status and trend information is very patchy and incomplete. A similar finding concerning inland wetland ecosystems and wetland-dependent species comes from the WRI summary analysis of the status and trends of inland water biodiversity prepared for the Convention on Biological Diversity [(COP8 DOC. xx)].
14. Management plans, including monitoring programmes, are not yet in place for xx% [to be added after analysis of COP8 National Reports] of designated Wetlands of International Importance, and the use of the Ramsar site 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), has not yet been established.
15. There is thus a need to provide mechanisms to ensure more comprehensive collection and reporting of such information critical to 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 and guided by an overarching framework for their application.

A conceptual framework for wetland ecosystem inventory, assessment and monitoring

16. The Millennium Ecosystem Assessment (MA) has been developed as an international assessment that is intended to improve the management of the world's natural and managed ecosystems by helping to meet the needs of decision-makers and the public for peer-reviewed, policy-relevant scientific information on the condition of ecosystems, consequences of ecosystem change, and options for response. It will directly provide information, and build capacity to provide further information, at both global and sub-global (local, national and regional (supra-national)) scales.
17. The MA has been developed by a diverse group of environmental, socio-economic, and policy experts who are undertaking the assessment over a four-year period from 2001 (see <http://www.millenniumassessment.org>). It has been designed to meet the needs of, *inter alia*, the Ramsar Convention, the Convention on Biological Diversity (CBD), and the UN Convention to Combat Desertification (UNCCD).

18. To guide its work, the MA has developed an overall “conceptual framework”, relating ecosystems and human well-being with the factors (drivers) influencing them, and this can be applied at different and multiple scales, from local to global, under which to make assessment (Figure 1). The framework contains four components – primary drivers, proximate drivers, ecosystems and their services, and human well-being and poverty reduction.
19. The MA’s conceptual framework is significant in terms of the goal and mission of the Ramsar Convention, since its fundamental tenet is the critical linkage between ecosystem services and human well-being and this lies at the core of the MA’s process. Hence the MA framework recognises that the maintenance of ecological systems is intertwined with the provision of ecosystems services, which in turn support people’s livelihoods and their well-being.
20. This applies as much to wetlands, whether inland, coastal or marine, as it does to other ecosystems, and the STRP has determined that the MA’s general ecosystem conceptual framework is an appropriate basis for the implementation of the Ramsar Convention’s ecosystem-based approach to the conservation and wise use of wetlands.

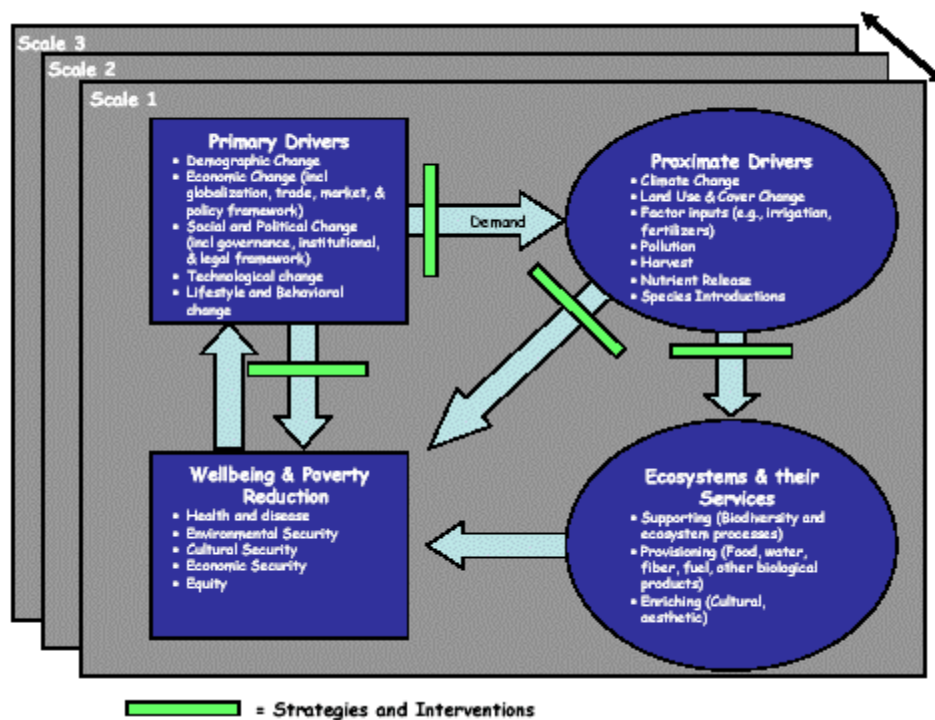


Figure 1: Millennium Ecosystem Assessment (MA) conceptual framework (from www.millenniumassessment.org/en/meetings/design.workshop.2.summary.pdf).

21. A significant feature of the MA conceptual framework is that it stresses the strong connection between human well-being and the provision of ecosystem services, and raising wide public and political recognition of this linkage will provide a strengthened basis for conserving ecosystems. The conceptual framework provides the demonstration that ecosystems and their services are intricately linked and that degradation of one will lead to

the loss or degradation of the other. Furthermore, the primary drivers and proximate drivers (pressures) that operate on wetlands will affect the well-being of people through the loss or degradation of the ecosystem services that the wetlands provide.

22. The categories of ecosystem services defined by the MA framework are: supporting (biodiversity and ecosystem processes), provisioning (food, water, fibre, fuel, other biological products), or enriching (cultural, aesthetic). These correspond to the products, functions, and attributes of wetlands as defined by the Ramsar Convention (Resolution VI.1). Thus, the ecosystem framework can be seen as supporting the Ramsar Convention by strengthening recognition of the link between wetland goods and services (comprising products, functions and attributes) and the well-being of people.
23. Further development and application of an integrated ecosystem inventory, assessment and monitoring framework to wetlands will encourage their further conservation and management in order to maintain their basic ecological character and their provision of goods and services. To do this effectively, it will be necessary to address both the socio-economic and biophysical causes of wetland loss and degradation.
24. As part of its operationalization of the conceptual framework, the MA is developing an overall multi-scalar methodology and guidelines for undertaking ecosystem assessments at sub-global scales, and this is being tested through demonstration assessments at different geographical scales and in differing ecosystems. This general methodology, once available, will be relevant to wetland ecosystem assessments, and an integrated and harmonised framework of Ramsar tools and guidance for wetland ecosystem inventory, assessment and monitoring, as described below, can link to the MA methodology through its practical mechanisms for collection and presentation of data and information.
25. The MA conceptual framework is an important tool for wetland conservation and wise use in that it also indicates where strategies or management interventions may be made to respond to the drivers of damaging change or loss of ecosystems and their goods and services.

An integrated wetland ecosystem inventory, assessment and monitoring framework

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

26. Working definitions for wetland inventory, assessment and monitoring were developed by the 2nd Conference on Wetlands and Development (Dakar, Senegal, 1998) and are incorporated into Ramsar's *Framework for Wetland Inventory* (Resolution VIII.xx): 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).

27. The relationship between these concepts is shown in Figure 2. 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.
28. Importantly, wetland inventory and wetland monitoring require differing 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 constitute monitoring.

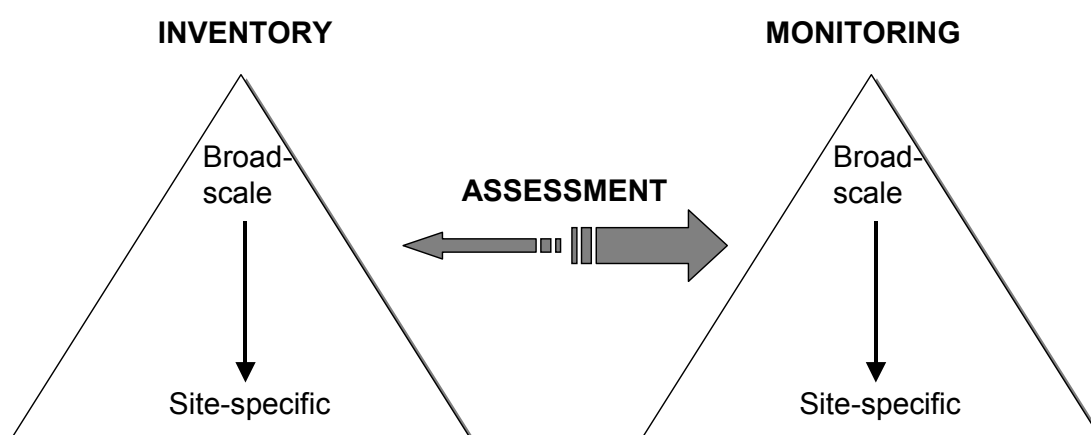


Figure 2. Concepts of wetland inventory, assessment and monitoring.

29. 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 data gathering exercises. They should be considered as linked elements of an overall integrated framework which, when implemented, provides for identification of key features of the character of wetlands and then provides the information needed for establishing strategies and policy and management interventions to maintain the defined character of the wetland ecosystem and the goods and services it provides for human well-being.
30. 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.
31. The data and information collected through inventory, assessment and monitoring are essential parts of an overall wetland management planning process, whether at the scale of defined wetland sites, or more broadly for mosaic wetlands, river basin or coastal zones, nationally and regionally. 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.xx)].

B. Guidance available to Ramsar Parties for implementing an integrated wetland ecosystem inventory, assessment and monitoring framework

32. A substantial set of Ramsar guidance, including further guidance being considered for adoption by Contracting Parties at COP8, already exists for wetland inventory, assessment, monitoring, and management. Guidance adopted up to and including COP7 has been compiled as Ramsar Wise Use Handbooks 7 and 8. Key guidelines are listed in Box 1.

Box 1. Guidelines available through the Ramsar Convention for implementing wetland inventory, assessment, monitoring, and management

Wetland inventory

Definitions of "ecological character" and "change in ecological character" (Resolution VII.10, Appendix VI).

A Framework for Wetland Inventory (Resolution VIII.xx)

Wetland assessment

Wetland risk assessment framework (Resolution VII.10)

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, and their relevance to the Ramsar Convention (Resolution VIII.xx)

The report of the World Commission on Dams (WCD) and its relevance to the Ramsar Convention (Resolution VIII.xx)

Wetland monitoring

A Framework for designing a wetland monitoring programme (Annex to Resolution VI.1)

Wetland management

New Guidelines for management planning for Ramsar sites and other wetlands (Resolution VIII.xx)

Guidelines for establishing and strengthening local communities' and indigenous people's participation in the management of wetlands (Resolution VII.8)

Guidelines for integrating wetland conservation and wise use into river basin management (Resolution VII.18)

Principles and guidelines on integrated coastal zone management (Resolution VIII.xx)

Guidelines for the allocation and management of water for maintaining the ecological functions of wetlands (Resolution VIII.xx)

33. In addition, there are a number of other ecosystem and wetlands and water-related global assessment initiatives currently underway, whose methodologies may be of relevance to the further development and implementation of an integrated wetland framework. These include, *inter alia*, the Millennium Ecosystem Assessment (MA) and in particular its sub-global assessment methodology and guidance, the Global International Waters Assessment (GIWA), UNESCO's World Water Assessment Programme (WWAP), and IUCN's Freshwater Biodiversity Assessment Programme.

- [34. The relevance of these to the Ramsar Convention in terms both of their methodologies and of the information on wetland status and trends they will provide, is summarised in Ramsar COP8 DOC. xx.]

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

35. Whilst there is a substantial methodology already available or under development for wetland inventory, assessment and monitoring, for a comprehensive Ramsar framework to be available for implementation by Contracting Parties and others certain additional methodological guidance needs to be developed.
36. The Scientific and Technical Review Panel (STRP) has determined that, as a priority, additional guidance is needed, in order to provide a more comprehensive set of tools for wetland ecosystem management. This should cover:
- i) developing methods for determining and defining the ecological character of Ramsar sites and other wetlands, including techniques for delineating and mapping wetlands and for evaluating and stating the values and functions, goods and services provided by wetlands;
 - ii) ensuring harmonization of statements of the ecological character, and change in ecological character, of different types of wetland ecosystems, as the basis for assessment and monitoring, in the Information Sheet on Ramsar Wetlands (RIS), core data fields recommended for wetland inventory (see Resolution VIII.xx), and other Convention procedures;
 - iii) incorporating assessment and management processes and practical methods developed by other programmes, including the Millennium Ecosystem Assessment (MA), into the Ramsar “Toolkit” of Wise Use Handbooks, including multi-scalar methods for assessment and monitoring;
 - iv) providing guidance on practical methods, including indicators, for monitoring wetlands and for the rapid assessment of wetland biodiversity, including both inland waters and coastal and marine systems, ensuring that any guidance and recommended methods prepared by the CBD on these topics is made fully available for Ramsar Convention implementation;
 - v) reviewing and as necessary refining the Ramsar Classification System for Wetland Type, as well as (bio)geographical regionalization schemes and their application in defining and reporting the ecological character of wetlands;
 - vi) incorporating environmental impact and strategic environmental assessment into wetland risk assessment procedures;
 - vii) reviewing the relevance and application of adaptive management methods to Ramsar sites and other wetlands, including as a response to the effects of global climate change; and

- viii) harmonizing definitions and terms throughout the suite of Ramsar guidance on inventory, assessment, monitoring and management of the ecological character of wetlands;
37. Mechanisms for reporting status and trends of wetland ecosystems, and the need to establish more effective information management and transfer systems are covered in the [COP8 Resolution] and Information Paper on the implementation of Article 3.2 of the Convention [(Resolution VIII.xx)].
- D. Developing and implementing multi-scalar approaches to wetland inventory, assessment and monitoring**
38. A key issue to address in implementing wetland inventory, assessment and monitoring is the choice of the scale at which to undertake the work, and the choice of appropriate methods for each scale.
39. The issue of scale has so far been most fully addressed for wetland inventory, and this is summarized below. However, many of the scale issues for inventory are also relevant for the application of wetland assessment and monitoring, but further evaluation of options for these elements of the overall process may be necessary.
40. 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: scale of predominance of specific wetland types;
 - iv) local – purpose: characteristics of individual wetlands; and
 - v) site – purpose: variability within individual wetlands.
41. Some wetland inventory methodologies, notably the Mediterranean Wetland Inventory and, more recently, the Asian Wetland Inventory (AWI), developed from a draft protocol for wetland inventory in Australia, have been developed as multi-scalar approaches and have been recognised 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.
42. 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;
 - 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.
43. 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 3).
44. 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.
45. 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.
46. However, it is important to recognise that, 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, and also serves to demonstrate the clear linkages between scales. It is possible to obtain data at any level within the hierarchy whether or not other levels have been or will be addressed. 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 recognise the limits or constraints on interpretation of the original data.
76. 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, such as those increasingly available on the World Wide Web;
 - Level 2 – desk study to identify the wetland regions within each geographic region using information already collated on geology, climate, hydrology, and vegetation;

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.

48. 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.

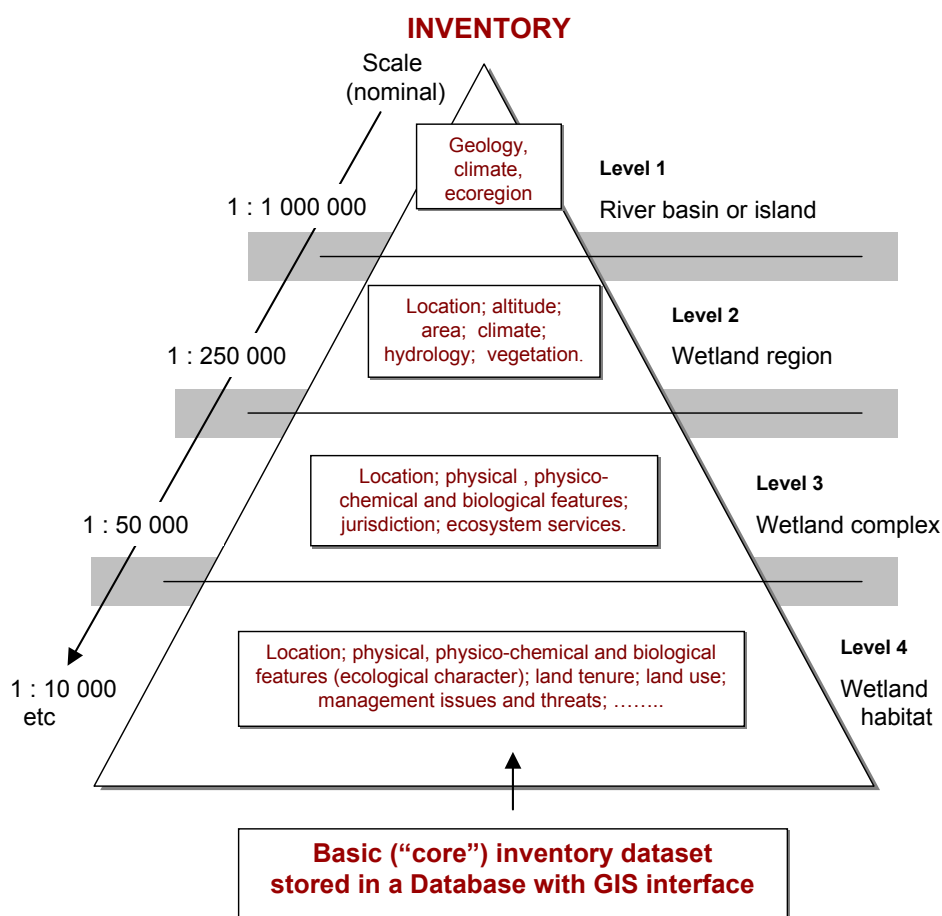


Figure 3. The hierarchical approach to wetland inventory.

49. 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.
50. However, it is acknowledged that detailed monitoring at broad scales is usually not possible because of its high cost, and so 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 and from where.

51. Typically, rapid assessment methods, including rapid biological assessment 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.

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

52. The following practical steps for improving integrated wetland inventory, assessment and monitoring are recommended as priorities:
- 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.xx).
 - ii) Once the baseline data have been acquired and adequately stored, more management-oriented information on wetland threats and uses, 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. This information should provide a basis for national assessment of wetlands and establishment of management priorities.
 - 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, notably 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 VIII.xx), 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), 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.