

Draft resolution on the rapid assessment of wetland ecosystem services

Submitted by the Republic of Korea

Action requested:

- The Standing Committee is invited to review the attached draft resolution for consideration at the 13th meeting of the Conference of the Parties.

Draft Resolution XIII.xx

The rapid assessment of wetland ecosystem services

1. RECALLING that Annex A to Resolution IX. 1 *Additional scientific and technical guidance for implementing the Ramsar wise use concept* defined the ecological character of wetlands as the combination of the ecosystem components, processes and benefits/services that characterise the wetland at a given point in time;
2. RECOGNIZING that to achieve the Mission of the Ramsar Convention it is essential that vital ecosystem functions and the ecosystem services that wetlands provide to people and nature are fully recognized, maintained, restored and wisely used;
3. NOTING that a priority area of focus for the Convention under the Ramsar Strategic Plan 2016-2024 is to enhance the information about ecosystem functions and the ecosystem services wetlands provide to people and nature;
4. FURTHER recognizing that under Resolution XII. 3 *Enhancing the languages of the Convention and its visibility and stature, and increasing synergies with other multilateral environmental agreements and other international institutions*, Parties and other stakeholders are encouraged to increase their efforts to communicate on the values of ecosystem services of wetlands in other sectors' strategies, plans and regulations, and integrate them into a basin approach to land-use plans and other relevant local, national and global decisions;
5. ACKNOWLEDGING that the important ecosystem services that wetlands provide have direct relevance to the achievement of the Sustainable Development Goals which are related to poverty eradication, food and nutrition, healthy living, gender equality, water quality and supply, water security, energy supply, reduction of natural disasters, innovation and the development of appropriate infrastructure, sustainable human settlements, adaptation to climate change, oceans, seas and marine resources, biodiversity and sustainable use of ecosystems;

6. RECOGNIZING the requirement to indicate the presence or absence of all relevant ecosystem services/benefits currently provided by each Ramsar Site when completing or updating the Ramsar Information Sheet and RECALLING the invitation to Contracting Parties to work with the Scientific and Technical Review Panel (STRP) to develop a more thorough understanding of the nature and extent of ecosystem benefits/services provided by Ramsar Sites individually and at national and global network scales and to report the outcomes of that work to the Standing Committee and the Conference of Parties;
7. FURTHER recognizing the STRP priority thematic work area for 2016-2018 which requested the development of methodologies for the economic and non-economic valuation of the values of the goods and services of wetlands; and the importance of integrating multiple wetland values into decision-making as described in Ramsar Policy Brief 2;
8. CONCERNED that only 17% of Contracting Parties reported to COP12 in their National Reports that they have made an assessment of the ecosystem benefits/services provided by Ramsar Sites;
9. ALSO CONCERNED that without the application of appropriate methodologies that the multiple values of wetlands will continue to be poorly recognized and integrated into decision-making; and
10. EXPRESSING appreciation to the Government of the Republic of Korea, Suncheon City (Republic of Korea), the International Union for Conservation of Nature (IUCN) and the Ramsar Regional Center – East Asia (RRC-EA) for their generous sponsorship and organization of workshops that laid the foundation for this Resolution;

THE CONFERENCE OF THE CONTRACTING PARTIES

11. WELCOMES the approach to the Rapid Assessment of Wetland Ecosystem Services annexed to this Resolution; and RECOGNIZES that it can be applied by Contracting Parties to assist their delivery on the targets of the Strategic Plan 2016-2024;
12. APPROVES the *Rapid Assessment of Wetland Ecosystem Services* annexed to this Resolution as a voluntary assessment approach for evaluating the ecosystem services of Ramsar Sites and other wetlands; ENCOURAGES Contracting Parties that do not already have effective approaches in place for the recognition and evaluation of ecosystem services provided by their Ramsar Sites and other wetlands to use the *Rapid Assessment of Wetland Ecosystem Services* approach; and CONFIRMS that this Resolution does not create additional reporting obligations for Parties;
13. ENCOURAGES Ramsar Site management authorities to apply the approach of the *Rapid Assessment of Wetland Ecosystem Services* in order to assess the ecosystem services that their Site provides, to contribute to the description of the ecological character of their Site and to ensure the maintenance of these services in their management processes; and ENCOURAGES Parties to use the data and information gathered to update the relevant sections of the Information Sheet on Ramsar Wetlands for the Site;
14. REAFFIRMS the long-term value of taking a participatory approach, involving indigenous peoples and local communities, subject to the respective national laws of the Contracting Parties when recognizing and understanding the ecosystem services provided by wetlands;

15. INVITES Contracting Parties to support the translation of the *Rapid Assessment of Wetland Ecosystem Services* annexed to this Resolution into languages which are not official languages of the Ramsar Convention;
16. URGES Contracting Parties to encourage Ramsar Site management authorities to use Ramsar communication tools including websites and social media to highlight more widely the ecosystem services provided by wetlands;
17. ENCOURAGES those who use the approach to the *Rapid Assessment of Wetland Ecosystem Services* to also refer to other relevant Ramsar guidelines, when making these assessments; and
18. ALSO ENCOURAGES Contracting Parties, where appropriate, to utilize the *Rapid Assessment of Wetland Ecosystem Services* when preparing their National Reports and describing the status of Sites on the List.

Annex 1

The Rapid Assessment of Wetland Ecosystem Services

Introduction

1. To achieve wise use, and for wetlands to contribute fully to sustainable development, policy-makers and practitioners (such as site managers) need to recognize the multiple values of wetlands, and reflect them in their decisions, policies and actions¹. Without wetlands, the water cycle, carbon cycle and nutrient cycle would be significantly altered, mostly detrimentally. Yet, often due to a failure to recognise these multiple, interconnected values, policies and decisions do not sufficiently take into account these interconnections and interdependencies².
2. The Ramsar Convention has recognised the need to integrate the multiple values of wetlands into decision making and has produced policy briefs¹, technical reports³ and wider guidance to address the importance of this issue. However, a review published in 2016 concluded that there is an urgent need to ensure that the requirement to assess a broad range of ecosystem services is achieved in accordance with the reporting obligations under the Ramsar Convention⁴. This improved awareness of and reporting on a comprehensive range of ecosystem services is required for both Ramsar Sites and other wetlands.
3. However, there are inherent limitations, including resourcing, access, cooperation and capacity, which have acted as barriers to more extensive attempts to recognise the multiple benefits that wetlands provide. Therefore, the development of procedures for assessing wetland ecosystem services should be targeted and pragmatic in their approach and involve local participation and indigenous knowledge.
4. Many wetland managers are limited with regards to both time and resources. Therefore, the development of approaches to assessing wetland ecosystem services needs to satisfy the definition of 'rapid' insofar that no more than two people should spend more than half a day in the field and another half day of preparation and analysis⁵.

The Rapid Assessment of Wetland Ecosystem Services (RAWES)

5. The development of the Rapid Assessment of Wetland Ecosystem Services (RAWES) approach has considered the requirements of the Ramsar Convention, and particularly the need for qualitative assessments which are not resource intensive and which can be applied within the

¹ Kumar, R., McInnes, R.J., Everard, M., Gardner, R.C., Kulindwa, K.A.A., Wittmer, H. and Infante Mata, D. (2017). *Integrating multiple wetland values into decision-making*. Ramsar Policy Brief No. 2. Gland, Switzerland: Ramsar Convention Secretariat.

² Russi D., ten Brink P., Farmer A., Badura T., Coates D., Förster J., Kumar R. and Davidson N. (2013). *The Economics of Ecosystems and Biodiversity for Water and Wetlands*. IEEP, London and Brussels; Ramsar Secretariat, Gland.

³ De Groot, R.S., Stuij, M.A.M., Finlayson, C.M. and Davidson, N. (2006). *Valuing wetlands: guidance 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. ISBN 2-940073-31-7.

⁴ McInnes, R.J., Simpson, M., Lopez, B., Hawkins, R. and Shore, R. (2016). Wetland ecosystem services and the Ramsar Convention: An assessment of needs. *Wetlands*. 37(1), 1-12.

⁵ Fennessy, M.S., Jacobs, A.D. and Kentula, M.E. (2007). An evaluation of rapid methods for assessing the ecological condition of wetlands. *Wetlands* 27 (3), 543–560.

context of Ramsar Convention-related reporting. However, consideration has also been given to developing an approach which would have wider utility as part of a broader suite of assessment approaches. Consequently, the objective of the RAWES approach is to facilitate a comprehensive assessment of the plurality of benefits provided by a wetland which can be considered genuinely rapid involving limited resources.

6. Based on an understanding of what is required by a specific, but global, wetland audience, the approach has at its core the realisation that in many situations the access to time, money and detailed information will be limited and such barriers need to be overcome if the full range of values is to be recognised. Furthermore, the development of the RAWES approach recognises that less time-intensive methods can be more applied at a range of scales, from the site to the landscape or catchment. Too often, assessments of ecosystem services are limited in their scope and fail to identify the multiplicity of benefits provided by wetlands, focussing on a few easy to recognise benefits, and consequently inherently assigning a default value of zero to these services and thereby excluding them from decision-making⁶.
7. The RAWES approach builds on similar techniques applied elsewhere⁷. A checklist of services grouped into functional categories as defined in the Millennium Ecosystem Assessment, namely provisioning, regulating, cultural and supporting services, acts as an initial structured framework. The category of supporting services is retained in RAWES as it recognises the functioning and resilience of productive ecosystems rather than valuation. Supporting services therefore constitute important considerations in terms of the resilience and capacity of ecosystems to provide wider benefits, and are therefore important considerations in management decision-making.
8. The list of ecosystem services in RAWES can be modified and adapted to the local context through dialogue and consultation with local stakeholders who are familiar with the wetland. Delimitation of the exact area to be assessed is defined objectively by the assessor depending on the purpose or scope of the assessment. The RAWES approach is flexible, allowing assessments to be made on different habitat units within a larger wetland complex or on an entire wetland site. The onus is on the assessor to define the 'wetland' and record the rationale behind the boundaries set and limits used. Since wetland ecosystems can be dynamic or can be subject to change or degradation, an important issue to be addressed is the definition of the condition at the time of the assessment. In some cases, the 'natural' condition will vary over time, and it will be necessary to ensure this temporal pattern is considered in the assessment of ecosystem services. For instance, the assessment could return different outcomes if it is conducted during a drought or when the area is subjected to flooding, both of which may represent natural phenomena within the broader tolerances of the system. In other circumstances, a wetland may be subject to on-going degradation, such as through pollution of surface water or infilling. Therefore, it cannot be safely assumed that the current situation reflects a 'natural' condition, and that service delivery is not already influenced by the prevailing conditions. The key issues are to ensure that a comprehensive range of ecosystem services is assessed, that the evidence used to achieve the assessment outcome is transparent and clear, and that the prevailing temporal context is recorded.

⁶ McInnes, R.J. and Everard, M. (2017). Rapid Assessment of Wetland Ecosystem Services (RAWES): An example from Colombo, Sri Lanka. *Ecosystem Services*. 25, 89-105. <http://dx.doi.org/10.1016/j.ecoser.2017.03.024>.

⁷ Defra. (2007). An introductory guide to valuing ecosystem services [online]. Department for Environment Food and Rural Affairs (Defra), pp. 68. Available from: www.defra.gov.uk.

Applying the RAWES approach

9. RAWES is designed as a simple and rapid site assessment system that may obtain input from existing studies but does not rely on detailed, quantitative assessments. As such, it is genuinely rapid approach that may typically take less than two hours per site with trained assessors working in pairs for cross-referencing. Significantly, the RAWES approach is also systemic, addressing all ecosystem services as a connected set rather than selecting only the most readily evaluated or exploited services, and thereby overlooking other services. The RAWES Field Assessment Sheet is included in Appendix 1, with an accompanying explanatory table to guide assessor thinking included at Appendix 2. The method has been used widely in Asia, Australia, Europe and Africa, with a database of sites and informing a number of scientific publications and site reports about the range and likely importance of ecosystem services provided by wetland sites.
10. RAWES can be used across a range of scales from whole-wetland to localised zones of large and complex wetlands; it is also in principle also relevant to other habitat types. The RAWES assessment form is a simple table with cells into which assessors record the importance of each ecosystem service produced at the wetland site, with space for free text descriptions of key features supporting that assessment. Assessors are encouraged to interact with stakeholders so that assessments are informed by local perspectives and indigenous knowledge, ensuring that all services are recognised. Early interaction is recommended in order to refine the list of services to be assessed.
11. The RAWES Field Assessment Sheet (Appendix 1) comprises the following sections:
 - Wetland name with GPS coordinates
 - Assessment date
 - Assessor name(s)
 - Table cells to record: (1) the importance of the service assessed using the following relative scale (adapted from Defra 2007, see Table 1 below); (2) free text box to describe the benefit; and (3) record of benefit realised at Local, Regional or Global scales.

Table 1. Defra (2007) scale of likely significance of ecosystem services

| <i>Score</i> | <i>Assessment of ecosystem service</i> |
|--------------|---|
| ++ | Potential significant positive contribution |
| + | Potential positive contribution |
| 0 | Negligible contribution |
| - | Potential negative contribution |
| -- | Potential significant negative contribution |
| ? | Gaps in evidence |

12. The assessment sheet provides an initial list of ecosystem services under the four main categories of provisioning, regulating, cultural and supporting services. This initial list should act as a starting point for considering the multiple benefits provided by a wetland. Assessors are encouraged to consider whether this list needs to be expanded or made more site/context specific in order to address specific services. For instance, 'food' is provided as a catch-all but could be sub-divided into more detail such as 'harvested crops', 'fish and shellfish' or 'collection of fruit and berries' if significant differences are experienced in the wetland under assessment.

Table 2. Linking services to beneficiaries at different scales.

- Local benefits: Those experienced by individuals, households or communities living and working in the immediate vicinity of the wetland.
- Regional benefits: Those delivered to individuals, households or communities living and working in the wider catchment of the wetland.
- Global benefits: Those that extend beyond national boundaries.

13. Scores are thus allocated semi-quantitatively, using assessor knowledge and other local and technical input. A more quantitative approach would be more resource-intensive, far from rapid, and would risk overlooking services not initially considered but potentially locally important, as well as skewing assessment towards the more readily exploited, marketable and therefore quantified services to the detriment to other important maintaining processes and wider benefits. The RAWES rapid method thus serves an operational need to incorporate ecosystem service assessment routinely into Ramsar site assessments and plans.
14. Training in rapid assessment methods has been highlighted as being essential if subjectivity is to be reduced and repeatability of results is to be enhanced⁸. Typically, a one-day training course mixing classroom and field sessions on the RAWES method suffices, with trained assessors undertaking independent surveys following the course for verification by the trainers and also to start building a local site database.
15. The outputs from applying the RAWES approach can be used to inform subsequent quantitative assessments of targeted ecosystem services, by effectively providing an initial screening, or in more general local or national policy frameworks and decision-making process such as environmental impact assessments.
16. The process for applying the RAWES approach comprises three principle activities: preparation, field assessment and information management. Simple graphics are provided in Figure 3 to inform this process.

Table 3. Process for applying the RAWES approach.

| Stage | Information |
|--|--|
| Preparation – Key Considerations | |
| Who will undertake the assessment? | <ul style="list-style-type: none"> • The assessment should be conducted by a minimum of two individuals working together. • The pair should be knowledgeable about the site and the type of wetland being assessed. |
| Where will the assessment be undertaken? | <ul style="list-style-type: none"> • The assessment should cover a defined area. • Ideally the area should be of a relative homogeneous habitat type but if it covers several different habitats this needs to be noted. |

⁸ Herlihy, A.T., Sifneos, J., Bason, C., Jacobs, A., Kentula, M.E., Fennessy, M.S. (2009). An approach for evaluating the repeatability of rapid wetland assessment methods: the effects of training and experience. *Environ. Manage.* 44 (2), 369–377.

| | |
|--|---|
| | <ul style="list-style-type: none"> • Health and safety considerations must be taken into account. |
| What is needed to undertake the assessment? | <ul style="list-style-type: none"> • Ensure that plenty of assessment sheets are available. • Use a clipboard and take several pens/pencils. • Take a camera and a GPS to record an image and the location. • Take appropriate personal protective equipment. |
| Field assessment – Key Considerations | |
| Observations | <ul style="list-style-type: none"> • Use field indicators to help recognise ecosystem services (see Appendix 2). • Understand the wider context of the site and the surrounding social and natural environment. • Think about the scale at which the service may be providing benefits. • Record actual services not potential. If there is no evidence do not record the service but make a note for future reference. |
| Local / indigenous knowledge | <ul style="list-style-type: none"> • Use local knowledge of how the site functions and how local communities interact with it. |
| Discussions | <ul style="list-style-type: none"> • Ensure that the assessors discuss issues between themselves and make reasoned conclusions. |
| Stakeholder engagement | <ul style="list-style-type: none"> • Wherever possible engage with local stakeholders to understand better the relationship between people and the wetland. • Think about a hierarchy of stakeholders from local (living/working in an immediately around the wetland), regional (those downstream and upstream of the wetland or in the wider region) and global (stakeholders and beneficiaries beyond national boundaries). |
| Recording information | <ul style="list-style-type: none"> • Ensure that as much information as possible is recorded so that others can understand the rationale for any assessments made. |
| Information management – Key Considerations | |
| Data checking | <ul style="list-style-type: none"> • Before leaving the field, check that all the required information has been recorded. |
| Data entry | <ul style="list-style-type: none"> • Ensure all data are entered onto Excel spreadsheets. • Use one spreadsheet for each assessment location. • Work in pairs to enter data. • If necessary check latitude/longitude on Google Earth |
| Summarising for future use | <ul style="list-style-type: none"> • Make a summary of the any key issues recorded such as constraints, uncertainties, impacts, threats, etc.. |

Appendix 1. RAWES Field assessment sheet

| RAPID ASSESSMENT OF WETLAND ECOSYSTEM SERVICES | | | | | | |
|--|--|------------------|------------------|----------|--------|--|
| FIELD ASSESSMENT SHEET | | | | | | |
| Key | How important? | Wetland name: | | | | |
| ++ | Potential significant positive benefit | GPS co-ordinates | | | | |
| + | Potential positive benefit | Date: | | | | |
| 0 | Negligible benefit | Assessors: | | | | |
| - | Potential negative benefit | | | | | |
| -- | Potential significant negative benefit | | | | | |
| ? | Gaps in evidence | | | | | |
| | | | Scale of benefit | | | |
| | | | Local | Regional | Global | |
| | | How important? | Describe benefit | | | |
| Provisioning services | Fresh water | | | | | |
| | Food | | | | | |
| | Fuel | | | | | |
| | Fibre | | | | | |
| | Genetic resources | | | | | |
| | Natural medicines or pharmaceuticals | | | | | |
| | Ornamental resources | | | | | |
| | Clay, mineral, aggregate harvesting | | | | | |
| | Waste disposal | | | | | |
| | Energy harvesting from natural air and water flows | | | | | |
| Regulatory services | Air quality regulation | | | | | |
| | Local climate regulation | | | | | |
| | Global climate regulation | | | | | |
| | Water regulation | | | | | |
| | Flood hazard regulation | | | | | |
| | Storm hazard regulation | | | | | |
| | Pest regulation | | | | | |
| | Disease regulation - human | | | | | |
| | Disease regulation - livestock | | | | | |
| | Erosion regulation | | | | | |
| | Water purification | | | | | |
| | Pollination | | | | | |
| | Salinity regulation | | | | | |
| | Fire regulation | | | | | |
| Noise and visual buffering | | | | | | |
| Cultural services | Cultural heritage | | | | | |
| | Recreation and tourism | | | | | |
| | Aesthetic value | | | | | |
| | Spiritual and religious value | | | | | |
| | Inspiration value | | | | | |
| | Social relations | | | | | |
| | Educational and research | | | | | |
| Supporting services | Soil formation | | | | | |
| | Primary production | | | | | |
| | Nutrient cycling | | | | | |
| | Water recycling | | | | | |
| | Provision of habitat | | | | | |
| Notes: | | | | | | |

Appendix 2. The initial list of wetland ecosystem services considered by the RAWES approach and examples of the indicator questions considered.

| | Ecosystem service | Example | Examples of questions assessors can ask about this service |
|------------------------------|--|---|---|
| Provisioning services | Provision of fresh water | Water used for domestic drinking supply, for irrigation, for livestock, etc. | <ul style="list-style-type: none"> • Does the wetland provide a source of fresh water? • Does the wetland store fresh water for human use? • Is the wetland a net source of pollution, degrading fresh water provision? |
| | Provision of food | Crops, fruit, fish, etc. | <ul style="list-style-type: none"> • What is grown in the wetland, either formally or from informal harvesting? • Are animals are harvested from the wetland? • Are livestock using the wetland? |
| | Provision of fibre | Timber for building, wool for clothing, etc. | <ul style="list-style-type: none"> • Are any natural materials such as wood, fibre, straw, animal fibre (wool/hide/sinew/antler/other) taken from the wetland? |
| | Provision of fuel | Fuelwood, peat, etc. | <ul style="list-style-type: none"> • Is any material taken from the wetland and used as fuel for domestic or other uses? |
| | Provision of genetic resources | Rare breeds used for crop/stock breeding, etc. | <ul style="list-style-type: none"> • Are any native or rare strains of plants and animals, wild and domesticated, which could contribute genetic diversity for human uses (for instance for drug manufacture, improving resilience of domestic animals and plants, horticultural trade, etc.) |
| | Provision of natural medicines and pharmaceuticals | Plants used as traditional medicines, etc. | <ul style="list-style-type: none"> • Are there any plants, animals or their parts derived from the wetland which are harvested and used for their medicinal properties? |
| | Provision of ornamental resources | Collection of shells, flowers, etc. | <ul style="list-style-type: none"> • Are there any plants, animals or their parts are derived from wetland that are collected and used/sold for their ornamental properties? |
| | Clay, mineral, aggregate harvesting | Sand and gravel extracted for building use, clay extracted for brick-making, etc. | <ul style="list-style-type: none"> • What substances are extracted or dug up from the wetland for construction or other human uses? |
| | Waste disposal | Dumping of solid waste, discharge of waste water, etc. | <ul style="list-style-type: none"> • Does the wetland provide a location for the disposal of liquid, solid or other waste materials? |
| | Energy harvesting from natural air and water flows | Water wheels driven by flowing water, windmills driven by the wind, etc. | <ul style="list-style-type: none"> • Are any technologies (water wheels, wind turbines, etc.) used to capture natural flows of energy through or across the wetland? |
| Regulating services | Air quality regulation | Removal of airborne particles from the exhaust of cars, chimneys of industry, dust from agricultural land, etc. | <ul style="list-style-type: none"> • Is there a source for airborne pollutants? • Does the wetland habitat structure help to settle out airborne pollutants? • Does the state of the wetland make it a source of air pollutants (microbial, particulate or chemical)? |
| | Local climate regulation | Regulation of the local microclimate, through shading, reducing air temperature, etc. | <ul style="list-style-type: none"> • Does the wetland habitat structure provide shade for humans? • Does the wetland have areas of standing water with or without vegetation that will be generating evapotranspiration and consequently reducing air temperatures? |
| | Global climate regulation | Regulation of the global climate through control in greenhouse gas emissions, the sequestration of carbon, etc. | <ul style="list-style-type: none"> • Does the wetland store and/or sequester carbon? • Does this balance with generation of methane and other greenhouse gases? |
| | Water regulation | Regulation of flows of surface water during high and low flows, regulation of recharge of groundwater, etc. | <ul style="list-style-type: none"> • Do the topography, permeability and roughness of the wetland enable it to store water during high rainfall/discharge and top slowly release it back to surface waters or to groundwater? • Does the wetland regulate discharges during dry periods to buffer low flows during dry weather? |

| | Ecosystem service | Example | Examples of questions assessors can ask about this service |
|--|--|---|--|
| | Flood hazard regulation | Regulation and storage of flood water, regulation of intense rainfall events, etc. | <ul style="list-style-type: none"> • Does the wetland regulate, store and retain floodwaters? • Does the wetland store rainfall and surface water that might contribute to flooding and damage to property or ecosystems downstream? |
| | Storm hazard regulation | Regulation of tidal or storm surges, regulation of extreme winds, etc. | <ul style="list-style-type: none"> • Does the complexity of habitat, particularly trees, tall reeds and other vegetation and surface topography, absorb energy from extreme events such as storms and waves that might otherwise damage property or adjacent ecosystems? |
| | Pest regulation | Control of pest species such as mosquitoes, rats, flies, etc. | <ul style="list-style-type: none"> • Do natural predation and other ecological processes in the wetland regulate and control pest organisms? • Is the wetland a source of pests (for example rats thriving in dirty water systems)? |
| | Regulation of human diseases | Presence of species that control the species (vectors) that transmit human diseases such as malaria, West Nile fever, dengue fever, Zika virus, leptospirosis, schistosomiasis, etc. | <ul style="list-style-type: none"> • Do natural predation and other ecological processes in the wetland regulate organisms that may cause human diseases? • Are faecal deposits, bacteria or other potentially pathogenic microbes immobilised by processes in the wetland? • Is the condition of the wetland contributing to the negative spread of populations of disease vectors (such as mosquitoes)? |
| | Regulation of diseases affecting livestock | Presence of species that control the species (vectors) that transmit diseases to livestock such as leptospirosis, schistosomiasis, duck virus enteritis, highly pathogenic avian influenza, tick-borne diseases, etc. | <ul style="list-style-type: none"> • Do natural predation and other ecological processes in the wetland regulate organisms that may cause diseases in livestock? • Are faecal deposits, bacteria or other potentially pathogenic microbes immobilised by processes in the wetland? • Is the condition of the wetland contributing to the negative spread of populations of disease vectors (such as mosquitoes or snails)? |
| | Erosion regulation | Regulation of energy environment to reduce risk of erosion, presence of dense vegetation protecting soils, etc. | <ul style="list-style-type: none"> • Does the wetland vegetation provide protection from erosion for the soils? • Are there any signs of erosion, such as bare earth, in the wetland? |
| | Water purification | Cleaning of water, improvement of water quality, deposition of silts, trapping of contaminants and pollutants, etc. | <ul style="list-style-type: none"> • Do physico-chemical (sunlight exposure in shallow waters, detention of water in aerobic and anaerobic microhabitats) and biological processes in the wetland result in the breakdown of organic, microbial and other pollutants in the water passing through? • Are suspended solids deposited? • Is there a noticeable change in the quality, such as the turbidity, of water entering and leaving the wetland? |
| | Pollination | Pollination of plants and crops by pollinators such as bees, butterflies, wasps, etc. | <ul style="list-style-type: none"> • Do populations of pollinating organisms (butterflies, wasps, bees, bats, etc.) in the wetland contribute to pollination within the wetland? • Do pollinators using the wetland also help to pollinate nearby crops, gardens, allotments, etc.? |
| | Salinity regulation | Freshwater in the wetland provides a barrier to saline waters. | <ul style="list-style-type: none"> • Does the hydrology of the wetland help prevent saline water contaminating freshwaters? • Does the presence of freshwater in the wetland prevent the salinisation of soils? |
| | Fire regulation | Providing physical barriers to the spread of fire, maintaining wet conditions to prevent fires spreading, etc. | <ul style="list-style-type: none"> • Does the configuration of waterbodies (ditches, streams, etc.) help to prevent the spread of fires? • Is there water at or near the soil surface that restricts the spread of fire? • Are organic rich or peat soils drained and susceptible to fire and burning? |

| | Ecosystem service | Example | Examples of questions assessors can ask about this service |
|-------------------|-------------------------------|--|---|
| | Noise and visual buffering | Wetland trees or tall reeds absorbing and buffering the impact of noise. | <ul style="list-style-type: none"> • Is there a source (busy road, industry, construction, etc.) and receptor (houses, wildlife, etc.) for noise pollution? • Does wetland ecosystem structure, particularly tall trees and reeds, provide visual screening as well as suppress noise transmission? |
| Cultural services | Cultural heritage | Importance of the wetland for historical or archaeological value, as an example of traditional uses or management practices, as a cultural landscape, etc. | <ul style="list-style-type: none"> • Does the wetland system have cultural importance, either due to its natural character or traditional uses? |
| | Recreation and tourism | Importance of the wetland for providing a location for recreation such as fishing, watersports or swimming, or as a tourism destination, etc. | <ul style="list-style-type: none"> • Is the wetland used for organised or informal recreational purposes? • Is there infrastructure provided for access and recreation? • Are their wider tourism/ecotourism benefits flowing from these uses? |
| | Aesthetic value | The wetland is overlooked by properties, is part of an of known area of natural beauty, is used as a subject for painters and artists, etc. | <ul style="list-style-type: none"> • Does the wetland provide aesthetic benefits through the desirability of siting houses of commercial development adjacent to it? • Does the presence of a wetland have a significant impact on property prices? • Is the wetland depicted in many works of art? |
| | Spiritual and religious value | The wetland holds plays a role in local religious festivals, the wetland is considered as a sacred site, the wetland forms part of a traditional belief system, etc. | <ul style="list-style-type: none"> • What spiritual and/or religious values do people derive from the wetland? • Does the wetland hold any important spiritual or cultural value to people? • Does the wetland play any part in traditional religious ceremonies? • Are there any traditional wetland management practices (such as the timing of planting and cropping of rice to Buddhist or other traditions and teachings) associated with the wetland? |
| | Inspirational value | Presence of local myths or stories relating to the wetland, traditional oral or written histories about the wetland or wetland animals, creation of different art forms associated with the wetland, development of distinct architecture based on the wetland, etc. | <ul style="list-style-type: none"> • Are there any particular myths or other folklore associated with the wetland? • Do any wetland animals appear or are featured in local stories and myths? • Does the wetland inspire people to create music or other forms of art? • Have particularly ways of designing and building developed which reflect the wetland? |
| | Social relations | Presence of fishing, grazing or cropping communities which have developed within and around the wetland. | <ul style="list-style-type: none"> • Have communities formed around the wetland and its uses, including for example fishing (subsistence, commercial and recreational), cropping or stock management, walking and jogging, birdwatching and photography, etc? |
| | Educational and research | Use of the wetland by local school children for education, site of long-term research and monitoring, site visited by organised educational study tours, etc. | <ul style="list-style-type: none"> • Is the wetland used for any educational purposes, organised or informal, ranging from school-level visits to university research and teaching? • Are there any public awareness or educational materials present? |

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| | Ecosystem service | Example | Examples of questions assessors can ask about this service |
|----------------------------|--------------------------|--|--|
| Supporting services | Soil formation | Deposition of sediment, accumulation of organic matter, etc. | <ul style="list-style-type: none"> Do accretion processes (both sedimentation of mineral material and the build up of organic material) on the wetland result in the formation of soils? |
| | Primary production | Presence of primary producers such as plants, algae, etc. | <ul style="list-style-type: none"> Do photosynthetic processes on the wetland produce organic matter and store energy in biochemical form? |
| | Nutrient cycling | Source of nutrients present from inputs from agricultural land, internal cycling of plant material, inputs of nutrients from floodwaters, presence of fauna to recycling nutrients, etc. | <ul style="list-style-type: none"> Do wetland processes biochemically transform nutrients (for example nitrification/denitrification)? Are nutrients settled out in particulate forms, changing the characteristics of water passing through the system? Are there abundant invertebrates and detritivores that are decomposing and cycling organic material? |
| | Water recycling | Presence of wetland vegetation and open water result in evapotranspiration and local recycling of water, relatively closed canopies and low exposure to winds retains water in local cycles, sandy or coarse substrates allow exchange with groundwaters, etc. | <ul style="list-style-type: none"> Does the structure of the wetland retain water in tight cycles (for example recapture of vapour produced by evapotranspiration)? Does the wetland enable exchanges with groundwater (either discharge or recharge)? |
| | Provision of habitat | Presence of locally important habitats and species, presence of species and habitats of conservation concern, etc. | <ul style="list-style-type: none"> Does the wetland support a diversity of locally representative biodiversity (plants and animals)? Does the wetland support species which humans consider of conservation concern or as charismatic interests? |