

Wetland Ecosystem Services and the Ramsar Convention: an Assessment of Needs

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Abstract The Ramsar Convention promotes the wise use of wetlands as a fundamental tenet behind the desire to stop and reverse the loss and degradation of wetlands. The concept of wise use has been formally defined as the maintenance of ecological character, of which ecosystem services form an integrated element. The Contracting Parties to the Convention submit formal National Reports (NRs) before the triennial Conference of Parties in order to report on progress towards implementation. The information contained in the National Reports submitted for the eleventh Conference of Parties (Bucharest, 2012) has been reviewed in order to assess progress made on understanding of and reporting on wetland ecosystem services. Notwithstanding concerns regarding the pedigree and utility of the information reported through the NRs, the review has demonstrated reporting on the benefits provided by Ramsar Sites is limited, that regional differences exist in the reporting on ecosystem services and that some ecosystem services are more frequently reported than others. Based on this evaluation recommendations for the future development of guidance for integrating assessment of wetland ecosystem services are proposed.

Keywords Wetlands · Ramsar convention · Ecosystem services · Wise use

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Introduction

The Convention on Wetlands (Ramsar, Iran, 1971) is an inter-governmental treaty whose mission is “the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world” (Resolution XII.2 2015). The concept of wise use of wetlands has been formally defined as the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development (Resolution IX.1 2005). The importance of using wetlands wisely for the benefit of human societies is not only highlighted in the original Convention text (Matthews 1993) but Contracting Parties (CPs) to the Convention have further committed themselves to this approach through the adoption of Resolutions which link wise use and ecological character (Finlayson et al. 2011). Within this context, ecological character specifically combines the ecosystem components, processes and benefits or services that characterise a wetland at a given point in time (Resolution IX.1 2005).

However, notwithstanding the acknowledgement of the benefits wetlands provide society (Russi et al. 2013) barriers still need to be overcome to progress from conceptual frameworks and theoretical approaches towards the practical integration of ecosystem services into decision-making (Daily and Matson 2008; de Groot et al. 2010). Despite there being a robust process for describing the ecological character of Ramsar Sites (Resolution X.15 2008) (and reviewed in Gardner and Davidson 2011), knowledge gaps exist in the mapping and assessment of ecosystem services (Maes et al. 2012) and shortcomings have been identified in the recognition of ecosystem services from Ramsar Sites in the United Kingdom (McInnes 2013), reflecting similar experiences elsewhere (DEWHA 2008; Davis and Brock 2008).

In recognition of this, the Eleventh Conference of Parties (COP11) to the Ramsar Convention (Bucharest, 2012) adopted two key resolutions. Resolution XI.8 (2012) proposed a revision to the recording of information on ecosystem services on the Information Sheet on Ramsar Wetlands (RIS) and Resolution XI.17 (2012) established a new work Theme for the Scientific and Technical Review Panel (STRP) of the Convention on Ecosystem Benefits/Services (EB/S). This paper reports on work which was requested of STRP to *conduct a user needs analysis for Ramsar Parties & wetland (site) managers on tools, knowledge, methodology and data required to support integration of ecosystem service values in planning and decision making* (Resolution XI.17 2012) and sets out recommendations for the Ramsar Convention and other relevant parties for both Ramsar Sites and wetlands in general.

Methods

CPs are required to submit a triennial National Report (NR) on the Implementation of the Ramsar Convention. Information collated from the NRs can be used to assess the extent of implementation within and between countries and to evaluate the effectiveness of the Ramsar Convention (Finlayson 2012). The NR serves a range of purposes including: providing data and information on implementation; capturing lessons to inform development of future actions; identifying emerging issues and implementation challenges; providing accountability; assessing and monitoring its progress in implementation; and highlighting achievements.

Information was extracted from the NRs submitted to COP11 (Bucharest, 2012) in order to assess specific reporting on progress towards the integration of ecosystem service values in planning and decision making for Ramsar Sites and also to provide insights into broader issues of wise use and specifically on the use of tools, knowledge, methodologies and data on wetland ecosystem services. The following questions were used to frame the assessment of these issues:

- 1) Has an assessment been conducted of the ecosystem services provided by Ramsar Sites?
- 2) Is the method for assessing ecosystem services identified?
- 3) Have qualitative, quantitative or monetary assessments of the value of ecosystem services been conducted?
- 4) At what frequency are provisioning, regulating cultural and supporting ecosystem services reported?
- 5) Does the reporting on ecosystem services vary among the six Ramsar regions and across countries of different levels of economic development?

- 6) Has research into ecosystem services been undertaken to inform wetland policies and plans?
- 7) Are there specific difficulties related to undertaking an assessment of ecosystem services?

An Excel database was created which included drop-down lists in order to keep the information in a consistent mode for analyses. The assessment of ecosystem services used a modified version of the Millennium Ecosystem Assessment nomenclature, and its division into provisioning, regulating, cultural and supporting services (Millennium Ecosystem Assessment 2005), which informed the nomenclature adopted in the 2012 revision to the RIS (Resolution XI.8 2012). Eighteen individual ecosystem services were considered in the analysis (Fig. 1). Responses to the questions posed reflected the approach adopted in the NRs and were restricted to the following four answers: ‘yes’, ‘no’, ‘partially’ and ‘unclear’. Results have been expressed as a global-level response and for each of the six Ramsar regions.

It has been reported that ecosystem services with indirect use and non-use values have received limited attention in the body of research into ecosystem services (Chan et al. 2012). As part of this assessment it was hypothesised that the reporting on ecosystem services in the NRs could also reflect this limitation and hence skew the reporting. Barbier et al. (1997) and Brander et al. (2006) have categorised ecosystem services by their value type (direct use, indirect use and non-use) and have identified the commonly applied valuation methods. The analysis of the NR has consequently assessed the extent to which reporting on ecosystem services varied according to the type of service under consideration, the type of value assigned and the method of valuation applied in order to examine this phenomenon.

An assessment of whether the level of economic development of a CP influenced the assessment of ecosystem services was conducted based on the following categories identified by the World Bank within their gross national income (GNI) per capita estimates (based on 2012 classification to correspond with the reporting period addressed by the NRs):

- Low income: \$1035 or less
- Lower middle income: \$1036 to \$4085
- Upper middle income: \$4086 to \$12,615
- High income: \$12,616 or more

Resolution III.3 (1987) established a system of regionalization in order to oversee the implementation of the Ramsar Convention. For technical and administrative reasons this system was refined in Resolution VII.1 (1999) to establish six regional groups: Africa, Asia, Neotropics, Europe, North America and Oceania. Whilst essentially being a geopolitical grouping, regionalization is considered a significant factor in the operation of the Convention (Ramsar Convention

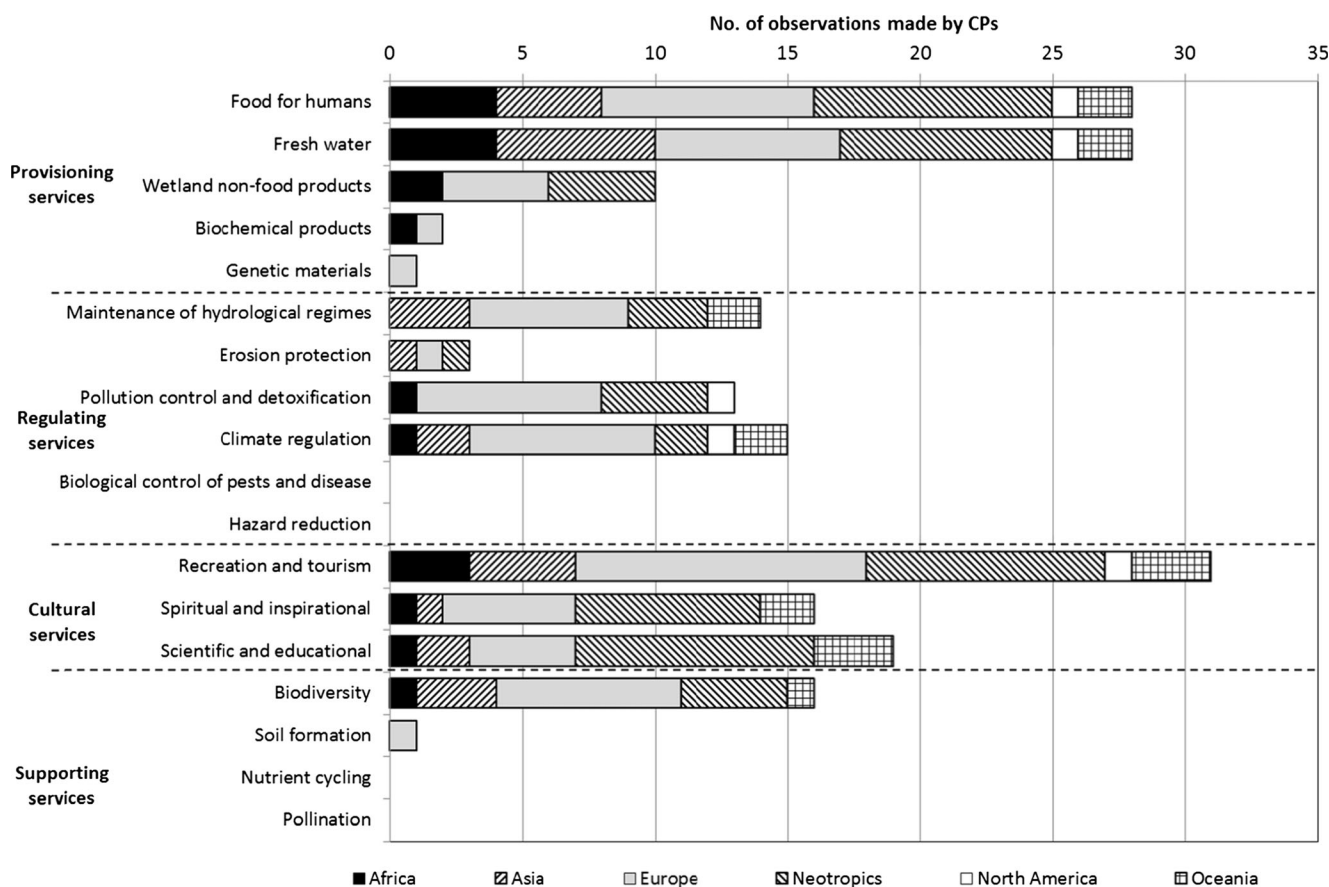


Fig. 1 Number of CPs, by region, which reported on different individual ecosystem services ($n = 149$)

Secretariat 2013) ensuring proper representation of developing countries (Resolution III.3 1987). Results of the analysis of the NRs are presented in relation to the different regions. This approach has been implemented elsewhere (for instance by Bonells and Zavagli (2011) in an assessment of the establishment and implementation of national wetland committees) and is adopted here as it has potential to inform the technical and operational dimensions of the Convention as well as to provide insights into variations in reporting on ecosystem services.

The production of NRs is essentially a political reporting process which nevertheless also has the potential to provide quantitative data on the status and trends of many wetlands at different scales (MacKay et al. 2009). Concerns have been raised regarding the pedigree of the information contained in the NRs produced for submission to the Ramsar COP, as well as those reporting on other multinational environmental agreements, and therefore their utility in providing robust analyses. Data gaps and incomplete submissions have been highlighted as barriers to the development of meaningful metrics and indicators (Walpole et al. 2009). Similarly, while NRs can furnish information on the implementation and legal operationalization of some COP decisions, Jóhannsdóttir et al. (2010) suggest that the data they provide can often be rudimentary and difficult to access and that lack of guidance

on completing NRs can manifest itself as differences in the content provided by the CPs (Herkenrath 2002). Notwithstanding these potential issues, every attempt has been made to extract data in a consistent and objective manner in order to provide sound information upon which to base an assessment. However, the authors acknowledge that the NRs may contain imperfect or partial information which potentially undermine the analyses conducted and weaken any conclusions drawn.

Results

Of the 163 Parties that were signatories to the Ramsar Convention at COP11 (July 2012) 150 submitted NRs. Not every CP reported an answer to every question in the NRs, reflecting the concerns raised by Jóhannsdóttir et al. (2010). Consequently the total responses for certain investigations considered in this assessment can be less than 150. NRs were available for all six Ramsar regions. The following number of NRs were reviewed per region (with total number of CPs in the region in parenthesis): Africa = 47(47); Asia = 26(31); Europe = 43(48); Neotropics = 24(27); North America = 3(3); and Oceania = 7(7).

Ecosystem Services Provided by Ramsar Sites

Globally, 38.00 % ($n = 57$) of CPs reported that an assessment of the ecosystem services had been conducted for their Ramsar Sites (Table 1). Significant regional differences were identified in the reporting (One-sample t -test: $t = 7.72$; $|t| = 2.57$; d.f. = 5; p -value 0.001; $\alpha = 0.05$). In North America an assessment of the ecosystem services provided by the Ramsar Sites has been reported for two of the three countries in the region; in Asia 53.85 % ($n = 14$) reported having conducted a similar assessment; and reporting in Europe (37.21 %; $n = 16$) was similar to the global figure. The CPs of the Africa region reported the lowest level of assessment of the ecosystem services at Ramsar Sites (25.53 %; $n = 12$). All countries reported the results as a binary yes or no and not as a partial assessment of the Ramsar Sites. Reporting on the actual methods used to assess ecosystem services at Ramsar Sites was limited (Table 2). Globally, less than one-in-ten (9.46 %; $n = 14$) of the CPs specified a discrete ecosystem services assessment methodology in their reporting.

The reporting of explicit information on the specific assessment methodologies employed in assessing ecosystem services was also limited. Reference was characteristically towards an approach rather than a specific method or published handbook or guidance document (Table 3). For instance, there were numerous references to ‘economic valuation’ but very limited indication as to the valuation techniques or approaches employed; or similarly for ‘financial and monetary values’ and ‘monetary assessment of wetland ecosystem services’. Several references were made to the assessment of ecosystem services within broader initiatives such as ‘flood mitigation’, ‘environmental impact assessment’, ‘agriculture-wetland interactions’ and ‘management plans’. In Europe, specific reference was made to an EU LIFE project and to the Pan-Mediterranean Inventory however the actual assessment approach within these initiatives was not reported. The most explicit reference to a published methodology was to the ‘choice experiment method’, as promulgated by

Table 1 Results for the question *has an assessment been conducted of the ecosystem benefits/services provided by Ramsar Sites?* ($n = 150$)

	Yes % (n)	No % (n)	Partial %	Unclear %
Global	38.00 (57)	62.00 (93)	0.00	0.00
Africa	25.53 (12)	74.47 (35)	0.00	0.00
Asia	53.85 (14)	46.15 (12)	0.00	0.00
Europe	37.21 (16)	62.79 (27)	0.00	0.00
Neotropics	41.67 (10)	58.33 (14)	0.00	0.00
North America	66.67 (2)	33.33 (1)	0.00	0.00
Oceania	42.86 (3)	57.14 (4)	0.00	0.00

Table 2 Results from the question *has the method for assessing ecosystem services at Ramsar Sites been identified?* ($n = 148$)

	Yes % (n)	No % (n)	Partial % (n)	Unclear % (n)
Global	9.46 (14)	90.54 (134)	0.00	0.00
Africa	6.38 (3)	93.62 (44)	0.00	0.00
Asia	11.54 (3)	88.46 (23)	0.00	0.00
Europe	9.52 (4)	90.48 (38)	0.00	0.00
Neotropics	12.50 (3)	83.33 (20)	0.00	0.00
North America	0.00	100.00 (3)	0.00	0.00
Oceania	14.29 (1)	85.71 (6)	0.00	0.00

Adamowicz et al. (1998), and an adaptation of the Millennium Ecosystem Assessment.

More CPs reported conducting an assessment of the monetary value of ecosystem services for Ramsar Sites (or monetised assessment) (10.00 % $n = 15$) than the use of qualitative (6.04 %; $n = 9$) or quantitative (5.37 %; $n = 8$) assessments (Table 4) but these differences are not considered significant (Kruskal–Wallis one-way analysis of variance: $K = 2.53$; $H = 5.99$; d.f. = 2; p -value 0.282; $\alpha = 0.05$). The majority of CPs did not report on whether a qualitative (90.60 %; $n = 135$), quantitative (91.28 %; $n = 136$) or monetised (86.67 %; $n = 130$) assessment of the ecosystem services at Ramsar Sites had been conducted.

Reporting on Individual Ecosystem Services

Eighteen individual ecosystem services were considered in the analysis based on a priori knowledge informed by the categories promulgated in Millennium Ecosystem Assessment

Table 3 Description of specific ecosystem service assessment methodologies used at Ramsar Sites as reported in NRs

Ecosystem service assessment method
Adaptation of the Millennium Ecosystem Assessment
Choice Experiment Method
Economic valuation
EU LIFE project
Financial and monetary values
Flood mitigation
Framework on the self-financing of protected areas
Monetary assessment of wetland ecosystem services
Pan Mediterranean Inventory
Valuation within environmental impact assessment
Agriculture-wetland interactions
Management plans
Payments for watershed services
Risk and conflicts affecting sustainable water management

Table 4 Percentage responses reporting whether qualitative ($n = 149$), quantitative ($n = 149$), quantitative ($n = 150$) assessments of the ecosystem services provided by Ramsar Sites have been conducted

	Qualitative					Quantitative					Monetised				
	Yes % (n)	No % (n)	Partial % (n)	Unclear % (n)		Yes % (n)	No % (n)	Partial % (n)	Unclear % (n)		Yes % (n)	No % (n)	Partial % (n)	Unclear % (n)	
Global	6.04 (9)	90.60 (135)	0.00 (0)	3.36 (5)		5.37 (8)	91.28 (136)	0.00 (0)	3.36 (5)		10.00 (15)	86.67 (130)	0.00 (0)	3.33 (5)	
Africa	2.13 (1)	97.87 (46)	0.00 (0)	0.00 (0)		4.26 (2)	95.74 (45)	0.00 (0)	0.00 (0)		6.38 (3)	93.62 (44)	0.00 (0)	0.00 (0)	
Asia	7.69 (2)	92.31 (24)	0.00 (0)	0.00 (0)		0.00 (0)	100.00 (26)	0.00 (0)	0.00 (0)		11.54 (3)	88.46 (23)	0.00 (0)	0.00 (0)	
Europe	7.14 (3)	88.10 (37)	0.00 (0)	4.76 (2)		4.76 (2)	90.48 (38)	0.00 (0)	4.76 (2)		9.52 (4)	88.10 (37)	0.00 (0)	4.76 (2)	
Neotropics	8.33 (2)	83.33 (20)	0.00 (0)	8.33 (2)		12.50 (3)	79.17 (19)	0.00 (0)	8.33 (2)		16.67 (4)	75.00 (18)	0.00 (0)	8.33 (2)	
North America	0.00 (0)	66.67 (2)	0.00 (0)	33.33 (1)		0.00 (0)	66.67 (2)	0.00 (0)	33.33 (1)		0.00 (0)	66.67 (2)	0.00 (0)	33.33 (1)	
Oceania	14.29 (1)	85.71 (6)	0.00 (0)	0.00 (0)		14.29 (1)	85.71 (6)	0.00 (0)	0.00 (0)		14.29 (1)	85.71 (6)	0.00 (0)	0.00 (0)	

(2005) and those adopted through Resolution XI.8 (2012) with regard to ecosystem services to be recorded on the RIS. The reporting on all individual ecosystem services varied significantly (Kruskal–Wallis one-way analysis of variance: $K = 64.72$; $H = 27.59$; $d.f. = 17$; $p\text{-value} < 0.0001$; $\alpha = 0.05$) suggesting that not all ecosystem services are reported equally. Multiple pairwise comparisons using Dunn's procedure (two-tailed test; $p\text{-value} < 0.0001$) grouped the frequency of reporting on ecosystem services into three groups: those that are reported at significantly high levels, those that are not reported and the remaining services. The ecosystem services most frequently reported by CPs were 'recreation and tourism' ($n = 31$), 'food for humans' ($n = 28$) and 'fresh water' ($n = 28$) (Fig. 1). These three services were reported from the six Ramsar Regions. The most frequently reported ecosystem service, 'recreation and tourism', was reported by approximately one fifth of all CPs who submitted NRs ($n = 31$; 20.67 %). Four ecosystem services were not reported in any of the NRs, namely 'biological control of pests and disease', 'hazard reduction', 'nutrient cycling' and 'pollination'.

Regional reporting on individual ecosystem services has been interrogated. The reporting of individual ecosystem services (Fig. 1) has been normalised for each region (by dividing the number of times an individual ecosystem service was reported in a region by the number of CPs in the region, whereby a normalised score of 1 would represent all CPs reporting an individual ecosystem service). For instance 'food for humans' was reported by four CPs in Africa, nine CPs in the Neotropics and two in Oceania. When normalised, values of 0.085, 0.375 and 0.286 are calculated for Africa, the Neotropics and Oceania respectively, reflecting a relatively lower level of reporting of this ecosystem service among the CPs in Africa. Analysis of variance suggests that there are no significant variations in the reporting of individual ecosystem services across the six regions (Kruskal–Wallis one-way analysis of variance: $K = 7.84$; $H = 11.07$; $d.f. = 5$; $p\text{-value} < 0.165$; $\alpha = 0.05$). Similarly, multiple pairwise comparisons using Dunn's procedure (two-tailed test; $p\text{-value} < 0.0033$) demonstrated no significant differences among the regions.

Descriptive statistics have been generated for the normalised data, including minima and maxima, 1st and 3rd quartiles and median and mean values. These are represented by a box plot (Fig. 2). Although not statistically significant, there are observable differences among the regions. African CPs have the lowest mean number of CPs reporting each ecosystem service, the lowest maximum number of CPs reporting an ecosystem service and the lowest inter-quartile range. Conversely Oceania and the Neotropics have the highest mean number of CPs reporting each ecosystem service, with Oceania reporting the highest relative number of CPs recording any ecosystem service, namely 'scientific and educational'. However, the data

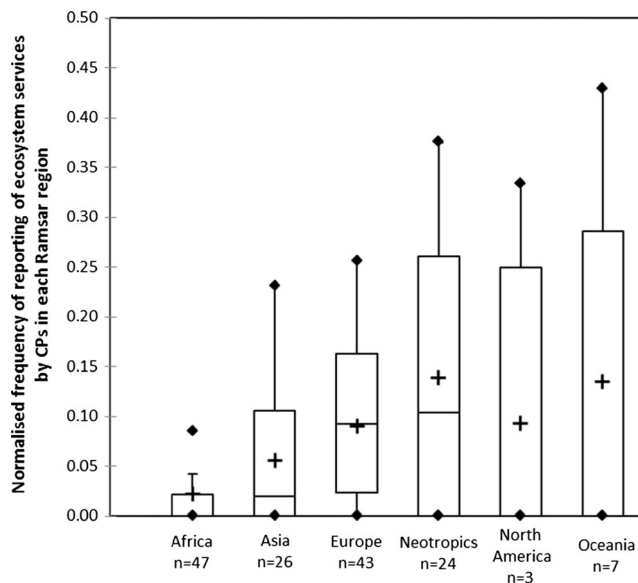


Fig. 2 Box plot for frequency of reporting on ecosystem services normalised for each region (number of times an individual ecosystem service was reported in a region divided by the number of CPs in the region) (Key: ◆ minima and maxima; + mean; box plot – 1st quartile, median, 3rd quartile)

reported from Oceania also demonstrates the greatest variability, as evidenced by the largest standard deviation of the six regions ($\sigma_{(n-1)} = 0.1659$).

Ecosystem Services and World Bank Income Categories

Each of the CPs that submitted a NR has been assigned to one of the four World Bank GNI per capita categories. The total number of ecosystem services, from the possible maximum of eighteen, has been identified for each country within the four World Bank GNI categories. As with the reporting of ecosystem services by region, the data have been normalised for each World Bank GNI category (by dividing the number of times an individual ecosystem service was reported in a GNI category by the number of CPs in the category). Analysis of variance suggests that there are significant variations in the reporting across the four income categories (Kruskal–Wallis one-way analysis of variance: $K = 9.49$; $H = 7.8$; d.f. = 3; p -value < 0.023; $\alpha = 0.05$). Multiple pairwise comparisons using Dunn's procedure demonstrated a significant differences among data reported by the low income and high income GNI categories (two-tailed test; p -value < 0.003).

Descriptive statistics have been generated for the normalised data based on the GNI categories, including minima and maxima, 1st and 3rd quartiles and median and mean values. The statistically significant differences among the four categories are clearly observable in a box plot (Fig. 3). CPs categorised as low income report ecosystem services at the lowest mean frequency, with the level of reporting

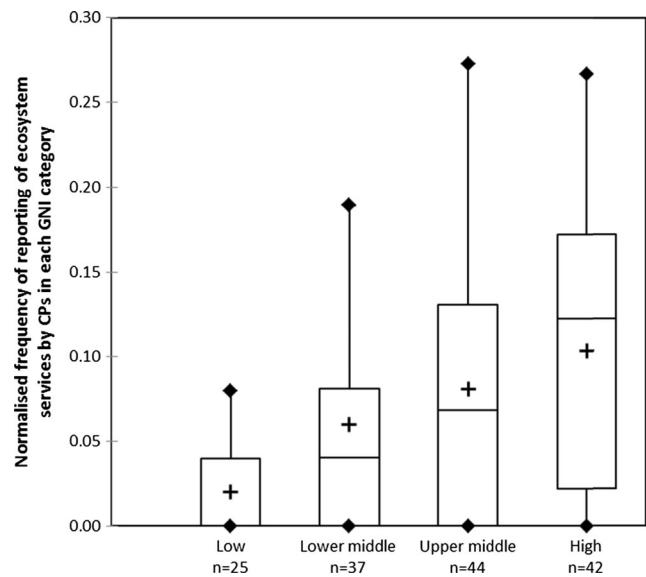


Fig. 3 Box plot for frequency of reporting on ecosystem services normalised for each World Bank GNI category (number of times an individual ecosystem service was reported in a region divided by the number of CPs in the category) (Key: ◆ minima and maxima; + mean; box plot – 1st quartile, median, 3rd quartile)

progressively increasing with income. High income CPs are more likely to report on a greater number of ecosystem services ($\sigma_{(n-1)} = 0.093$; inter-quartile range = 0.150) than lower middle and upper middle income CPs and at significantly greater frequencies than low income countries ($\sigma_{(n-1)} = 0.028$; inter-quartile range = 0.040).

Value Types and Valuation Methodologies

Assessment of ecosystem services can involve a monetary valuation of services (TEEB 2010). The concept of 'total economic value' (TEV) provides a framework for identifying and grouping values which distinguishes between 'use' values and 'non-use' values (Barbier et al. 1997; Brander et al. 2006), the latter referring to the current or future values associated with a wetland merely existing and unrelated to use, such as the biodiversity it supports or its spiritual significance (Pearce and Warford 1993). Use values can be grouped as 'direct' (common values such as harvested foods, collection of fuelwood or building materials and use for recreation) or 'indirect use' (predominantly associated with regulating and supporting ecosystem services).

The frequency of reporting on individual ecosystem services is considered to be independent of their prescribed non-use, direct use or indirect use values (Wilks' Lambda test: p -value < 0.059; $\alpha = 0.05$). However significant differences are observed within each of these three classes of value regarding the frequency at which individual ecosystem services are reported (Box test χ^2 asymptotic assumption: p -value < 0.027; $\alpha = 0.05$).

Ecosystem Services and Wetland Policies and Plans

Understanding the importance of ecosystem services is fundamental to assessing the value of wetlands and describing ecological character. Reporting in the NRs suggests that wetland policies and plans are only informed by information on the value of wetland ecosystem services in less than half of the CPs ($n = 66$; 44.00 %) (Table 5), however significant regional differences were identified in the reporting (One-sample t -test: $t = 5.73$; $|t| = 2.45$; d.f. = 6; p -value 0.001; $\alpha = 0.05$). Levels of reporting on the integration of ecosystem values in plans and policies are lowest from Oceania (28.57 %; $n = 2$). Europe (38.10 %; $n = 16$) and Africa (38.30 %; $n = 18$) and highest from North America (100 %; $n = 3$) and Asia (57.69 %; $n = 15$).

Difficulties Related to Undertaking an Assessment of Ecosystem Services

The NR requires CPs to report explicitly on the greatest difficulties they have in implementing the Convention. The narrative provided by CPs has been reviewed and extracted where it relates to issues associated with the understanding and assessment of ecosystem services. This corpora has been codified into eleven categories based on common themes present in the narrative (Table 6).

Five of the difficulties were only reported by one CP (no national wetland strategy, lack of cooperation across government departments, lack of data and information, need for scientific and technical support and the unpredictability of climate). Highlighted in four of the six regions, the most widely reported difficulty across the Ramsar regions was understanding ecosystem services within the context of conflicts between wise use and exploitation of wetlands. A lack of understanding of the different values of ecosystem services was reported by three CPs in Europe but not from the CPs in the other regions. Access to (Ramsar) sites was reported as a barrier to

understanding ecosystem services by CPs in Africa and the Neotropics. Difficulties in engaging with local communities were reported from CPs in Asia and the Neotropics. The most frequently reported difficulty encountered in Africa was a lack of funding.

Discussion

The continued loss of biodiversity and degradation of wetland ecosystems (Davidson 2014) is due, in part, to the inadequacy of the means to capture the value to society of ecosystem services (Millennium Ecosystem Assessment 2005; Kumar and Kumar 2008). Ramsar Sites have been described as the ‘jewels in the wetland crown’ (Taylor 2002) and maintaining their ‘ecological character’, which includes the combination of the ecosystem components, processes and benefits or services that characterize the wetland at a given point in time (Resolution IX.1 2005), is fundamental to the successful implementation of the Convention. Similarly, delivering on wetland ‘wise use’, which has been equated to the maintenance of ecosystem services to ensure the long-term maintenance of both biodiversity and human well-being (Horwitz and Finlayson 2011), is a fundamental tenet of the Ramsar Convention. To achieve these dual goals requires robust information on the multiple benefits wetlands provide human society.

This assessment has highlighted that the CPs to the Ramsar Convention demonstrated significant differences in the reporting on individual ecosystem services, suggesting that not all services are reported equally. This may be an artefact of the reporting process. Information on individual ecosystem services was not specifically requested within the NRs. The information provided on individual services was reported voluntarily in response to questions (such as ‘have socio-economic and cultural values of wetlands been included in the management planning for Ramsar Sites and other wetlands?’). Therefore individual ecosystem services may have been under-reported. In their survey of African Ramsar Sites, Gardner et al. (2009) used a questionnaire based on a stated preference approach utilising a finite list of wetland benefits against which respondents ranked the scale of the benefit provided resulting in nearly all those encompassed by the Millennium Ecosystem Assessment being identified. However, where respondents have had to act more independently, for instance in completing a RIS for site designation, it has been demonstrated that several ecosystem services can remain unrecognised (McInnes 2013). Alternatively, the bias in reporting on ecosystem services may reflect the dominance in the published literature of studies which predominantly emphasise five or fewer ecosystem services simultaneously or country-specific priorities regarding certain ecosystem services (Seppelt et al. 2011).

Table 5 The frequency that research into the value of ecosystem services was reported as being undertaken to inform wetland policies and plans ($n = 150$)

	Yes % (n)	No % (n)	Partial % (n)	Unclear % (n)
Global	44.00 (66)	56.00 (84)	0.00	0.00
Africa	38.30 (18)	61.70 (29)	0.00	0.00
Asia	57.69 (15)	42.31 (11)	0.00	0.00
Europe	38.10 (16)	64.29 (27)	0.00	0.00
Neotropics	50.00 (12)	50.00 (12)	0.00	0.00
North America	100.00 (3)	0.00 (1)	0.00	0.00
Oceania	28.57 (2)	71.43 (5)	0.00	0.00

Table 6 Reporting on the difficulties involved in understanding and undertaking ecosystem service assessments. Key: Difficulty reported by: ● one

CP; ● two CPs; ● three CPs; ● four or more CPs; blank – difficulty not reported

Difficulties reported	Region					
	Africa	Asia	Europe	Neotropics	North America	Oceania
No national wetland strategy	●					
Lack of funding	●●●			●		
Lack of cooperation across government departments	●					
Lack of data and information	●					
Remoteness of or access to (Ramsar) sites	●			●		
Difficulties with engaging with local communities		●		●		
Need for technical and scientific support		●				
Unpredictable and variable climate						●
Lack of awareness of wetland values in wider society				●	●	
Lack of understanding of different values			●●			
Conflicts between wise use and exploitation of wetlands	●	●	●	●		

Three statistically significant categories of ecosystem services were defined: those reported at high frequencies, those not reported and the remainder. It is not clear whether the ecosystem services that are reported at high frequencies (food for humans, freshwater provision and recreation and tourism) is a result of their greater frequency of occurrence, higher levels of visibility and awareness, ambiguity or clarity in their definition (Wallace 2007; Johnston and Russell 2011) or an inherent underrepresentation of other services (Locatelli et al. 2011; Bommarco et al. 2013). The frequency of reporting may partially reflect the findings of Plieninger et al. (2013) who suggested that, with the exception of recreation and tourism, cultural services are rarely considered in ecosystem services assessments. Similarly, observations on four Ramsar Sites in the United Kingdom (McInnes 2013) and an analyse of 153 case studies from around the world (Seppelt et al. 2011) demonstrated a strong bias towards the reporting of provisioning services and in particular food for humans and the provision of freshwater water.

Four ecosystem services were not reported within the NRs (pollination, nutrient cycling, hazard reduction and the control of pests and disease). It is not clear whether this represents reporting bias in the NRs or whether a recognition gap may be present, as has been identified in urban wetlands (McInnes 2014), or more general issues relating to the under-recording of non-provisioning services (Everard and McInnes 2013).

When prompted, with the exception of the control of pests and disease, the benefits of the other ecosystem services were reported previously for Ramsar Sites in Africa (Gardner et al. 2009). Similarly, where comprehensive checklists or frameworks of ecosystem services are employed it is usual that the importance of these four services is reported (Everard et al. 2010; Maynard et al. 2010). There also remains the, admittedly unlikely, proposition that these four ecosystem services may not be being delivered by wetlands in some countries, hence explaining their absence in the reporting.

Significant differences were observed in the reporting across the six Ramsar regions on the assessment of Ramsar Sites. Despite their global importance, the reporting suggest that less than two fifths of all Ramsar Sites have had an assessment conducted of their ecosystem services, with the lowest level of reporting observed from the CPs in the Africa region. Whilst not statistically significant, differences were also observed in the reporting of individual ecosystems across the regions, with the African CPs reporting less different ecosystem services and at relatively lower frequencies than the other five regions. This may reflect the view that due to limited studies the understanding and assessment of the benefits of ecosystem services under tropical conditions in developing countries can be compromised (Mertz et al. 2007), wider concerns regarding the lack of understanding of the value of nature in countries with developing economies (Christie et al.

2012) or the lack of resources, knowledge and cooperation available in Africa, as evidenced from the reporting on difficulties, which may be acting as barriers to conducting assessments of ecosystem services.

The economic status of the country may also influence the evaluation of and reporting on ecosystem services. Significant differences in reporting were observed across the four World Bank GNI categories with low income CPs reporting ecosystem services at a lower frequency. This is potentially at odds with the often purported view that people from the poorest nations have the greatest dependency on ecosystem services (Kenter et al. 2011; Christie et al. 2012) and therefore awareness could be considered to be greater. However, it might also demonstrate limitations on understanding ecosystem services and incorporating them into wider biodiversity-related plans and projects (as experienced in Madagascar, see Wendland et al. 2010), the paucity of credible evidence on ecosystem services available in the poorest nations (Tallis et al. 2008) or a tendency for poorer countries to focus on developmental rather than ecological aspects in relation to environmental decision-making and governance (Najam 2005).

The regional and economic differences observed in reporting may have implications for the future delivery of the objectives of the Ramsar Convention and the targeted actions of the regional teams within the Ramsar Secretariat. The rates of wetland loss in the relatively wealthy nations of Europe and North America have slowed in recent decades but remain high in Asia and are poorly reported for Africa (Davidson 2014). Improved knowledge of the benefits provided by wetlands in the poorer nations could contribute to decision-making and assist in the desire of the Ramsar Convention to ‘stem the loss and degradation of wetlands’, deliver more widely on environmental protection (Chan et al. 2006; Tallis et al. 2008; McInnes 2014) and develop better understanding the multiple values of wetlands in developing countries (Brander et al. 2006). In relation to the delivery of the Ramsar Convention’s obligations in Africa, Tiega (2001) identified insufficient knowledge of wetlands and their importance as representing one of the main threats and problems.

Reflecting concerns expressed by other authors (Davis and Brock 2008; McInnes 2013), the reporting provided limited clarity or consistency on the use of assessment methods and approaches for recognising and capturing ecosystem services. Since the publication of the Millennium Ecosystem Assessment there has been a profusion of methods and approaches which offer a variety of options for assessing ecosystem services. Some methods work at the site scale (Maltby 2009; CCI and Birdlife International 2011; Everard and Waters 2013; Peh et al. 2013), others are designed to integrate with development planning (Kosmus et al. 2012) whilst methodologies are also available for the corporate sector (OGP/IPIECA

2011; WBCSD 2011). None of the available practical approaches were explicitly reported.

Globally, the reporting suggests that there is a greater, but not significant, propensity to seek a monetary valuation of ecosystem services rather than to undertake qualitative or quantitative assessments. Indirect use services, essentially regulating and supporting services, are the least reported and those with direct use values, such as food, freshwater and recreation are the most frequently reported. This might be symptomatic of the commodity fetishism that has evolved around ecosystem services and the ambition to create markets for the benefit of nature conservation (Kosoy and Corbera 2010), practical and epistemological differences between ‘wetland managers’ and environmental economists who may possess very different perspectives on the value of ecosystem services (Kumar and Kumar 2008) or simply an artefact of the desire to commodify nature as an attempt to raise awareness of the importance of biodiversity to humanity (Robertson 2006; Peterson et al. 2010). However, it is not clear from the reporting whether monetary valuations of ecosystem services have been preceded by the qualitative or quantitative assessments in the hierarchical approach as advocated by TEEB (2010). This may reflect the common interchangeability in discussions on ecosystem services of the terms valuation, economic valuation and monetary valuation (Gómez-Baggethun et al. 2014) or it may represent a preconception on valuation held by the CPs completing the NRs.

Communications and awareness-raising are essential components of the Ramsar Convention (Polajnar 2008; Finlayson et al. 2011; Gardner and Davidson 2011). The bias in the reporting on certain ecosystem services may also reflect the influence of Ramsar-related communications, education, participation and awareness-raising programmes. For instance, themes promoted through World Wetlands Day (a cornerstone of the communications programme of the Ramsar Convention) in the triennium prior to the submission of the NRs have addressed ‘Upstream, downstream – wetlands connect us all’ (2009), ‘Caring for wetlands - an answer for climate change’ (2010), ‘Forests for water and wetlands’ (2011) and ‘Wetland tourism – a great experience’ (2012). Potentially some of these thematic messages may have elevated understanding of certain ecosystem services, such as freshwater and recreation/tourism, at the expense of others. Or the significant bias in reporting may simply be the result of applying an unsystematic and inconsistent approach to the recording of ecosystem service as has been observed elsewhere (see Nahlik et al. 2012).

Ultimately the analysis presented is dependent on the quality and consistency of the information provided in the NRs. It is acknowledged that the NRs have the potential to provide quantitative data on wetlands (MacKay et al. 2009) and while the overall level of reporting on the Ramsar Convention can be considered reasonably impressive in comparison with the

general standards for environmental treaties (Bowman 2002), the quality of the data reported in the NRs remains unverifiable (Walpole et al. 2009; Jóhannsdóttir et al. 2010). It must be borne in mind that NRs are prepared by national authorities responsible for implementation of the Convention and are not accompanied by supporting documentation (Finlayson 2012). Concerns have been raised elsewhere that the lack of a systematic reporting system fails to deliver a transparent and overarching view of implementation of the Ramsar Convention (BMT WBM 2007). Therefore the potential for misreporting or inaccuracies in the NR remains and requires consideration when drawing conclusions.

One of the benefits of the national reporting process is that the NRs can provide a significant source of time-series data on the implementation of the Ramsar Convention. Notwithstanding the issues surrounding data pedigree and utility, there would be merit in repeating the analysis conducted herein for the NRs submitted to COP12 (2015), however resource limitations currently preclude such an assessment.

Understanding and reporting on ecosystem services is a critical component of delivering wise use of wetlands and maintaining the ecological character of Ramsar Sites (Finlayson et al. 2011). Stemming the loss of wetlands is essential in order to maintain the water-related ecosystem services which underpin human well-being (Horwitz and Finlayson 2011; Russi et al. 2013). The analyses of the NRs prepared for COP11 demonstrate that reporting on and understanding of ecosystem services is only being partially achieved. In developing further guidance for implementation of the Ramsar Convention and wider considerations of wetland wise-use the following recommendations are made.

Recommendations

- (1) There is an urgent need to ensure that the requirement to assess a broad range of ecosystem services for Ramsar Sites is achieved in accordance with the reporting obligations. Updates to the RIS should assist in expediting this process. However to facilitate such reporting information on the location and application of the plethora of existing guidance should be made available to Ramsar Site Managers. The assessment of ecosystem services at Ramsar Sites should involve Site Managers and relevant stakeholders to ensure that practical delivery is context and resource specific.
- (2) Improved awareness of and reporting on a comprehensive range of ecosystem services is required for both Ramsar Sites and other wetlands. In addition to the application of existing guidance (some of which may be limited in the range of ecosystem services it addresses, e.g. Peh et al. 2013), guidance on the assessment of

ecosystem services should be developed to include qualitative, quantitative and monetary approaches. TEEB (2010) has proposed a conceptual, hierarchical approach which facilitates a progression from recognition of services to the capturing of values (including monetary and non-monetary values). This approach needs to be developed into a practical, formal process for recognising the full range of benefits provided by a wetland and communicated to all relevant wetland managers.

- (3) Efforts to develop guidance and to assist in reporting processes for ecosystem services should be targeted at low income countries and especially African countries where the reporting indicates that the need is greatest. However, these efforts must remain cognisant of limitations, including resourcing, access, cooperation and capacity, and therefore should be targeted and pragmatic in their approach and involve the appropriate regional teams from within the Ramsar Secretariat.
- (4) Links between ecosystem services and national policies need to be strengthened so that the values of wetlands are better captured and disseminated through all levels and sectors of government. This will require specific guidance aimed at high-level governmental decision and policy-makers.
- (5) Future NRs should consider more nuanced and targeting questions on ecosystem services in order to overcome the potential data limitations identified in this study and to provide more robust information to inform on-going decision-making.

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