Identifying priorities for reform to integrate coastal wetland ecosystem services into law and policy

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ABSTRACT

The ecosystem services concept has been slow to integrate into written law and policy in Australia. We sought to examine whether the concept has permeated deeper into practice, focusing on the coastal wetland protection, management and restoration context. We conducted a Delphi study involving 16 key informants. Over two rounds of interviews we found confirmation that the ecosystem services concept is not a central part of practice, and a strong consensus support for integrating and mainstreaming ecosystem services into law and policy through law reform. Our informants also provided additional new insights on how reform should proceed: (1) integration may occur through consolidated or interconnected law and policy instruments, (2) decision-maker discretion should be retained but subject to constraints, especially regarding (3) trade-offs between different ecosystem services and ecosystem services and other land uses. Our informants also called for (4) more effective and targeted policy to facilitate restoration projects, (5) incentivised protection and restoration across land tenure types, especially on privately-owned land and (6) caution in dealing with trade-offs and financial valuations of ecosystem services. The insights provided through this Delphi study will be instructive for law and policy reform in Australia and other jurisdictions grappling with fragmented management, protection and restoration of coastal wetlands.

1. Introduction

The ecosystem services concept has been a major focus of environmental science, research and practice across the globe for the past 20 plus years (Constanza et al., 2017), with these services recognised as critically important to human life (e.g. as articulated in the Millennium Ecosystem Assessment 2005 and implicit in the Sustainable Development Goals (Wood et al., 2018)). Despite this broad recognition, the ecosystem services concept has been slow to penetrate into written law and policy (see e.g., Pittock, Cork and Maynard, 2012; Keenan, Pozza and Fitzsimons, 2019; Bell-James, Boardman and Foster, 2020) and may be overlooked in land use decision-making in the absence of an explicit requirement to consider it (Nelson et al., 2009; Mikša et al., 2020). Given that strong, effective and well-enforced environmental laws are vital to ensuring the natural environment is protected (see e.g., UNEP, 2019), it is useful to consider whether better integration of the ecosystem services framing in law could lead to more robust environmental protection.

Our earlier desktop survey examined in detail the extent to which the ecosystem services concept is integrated into legal frameworks in Australia in the context of coastal wetlands (Bell-James, Boardman and Foster, 2020). This study found that the concept is rarely found in legislation, but often featured in other policy instruments, and often only mentioned for context rather than an explicit consideration for decision-makers. It also found that only some ecosystem services (e.g., fisheries, but not carbon sequestration) are mentioned, and multiple ecosystem services were rarely addressed in an integrated manner through a single instrument. Combined with definitional issues, large volumes of policy and a lack of harmonisation, the study found that the current laws as drafted were deficient in their treatment of ecosystem services, and suggested that law reform is needed (Bell-James, Boardman and Foster, 2020).

Building on this, we undertook an empirical study of experts working in the protection, management and restoration of coastal wetlands with two related objectives. First, we sought to investigate whether this limited recognition of ecosystem services in written law and policy

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translated to problems with the protection, management and restoration of coastal wetlands in practice. Although our earlier study identified major problems in the law as drafted, we speculated that the ecosystem services concept could have permeated more deeply into practice, thus circumventing these issues, and we sought to determine whether this had occurred. Second, if our study supported the need for law reform in this area, we sought to canvas expert opinion regarding key priorities for this law reform. Our empirical study consisted of interviews with 16 key informants using the Delphi method, and through two rounds of interviews we found a high level of consensus that the practice of wetland protection, management and restoration is hindered by the state of law and policy. Our experts confirmed the need to reform laws to include and integrate considerations of ecosystem services on a more holistic basis, in line with the findings of the earlier desktop study. Crucially, our informants also provided new insights regarding priorities for reform. In particular, there was broad agreement that there is a need for further work to determine how to most effectively manage ecosystems across public and private land tenures, and how to facilitate restoration projects. From the interviews we compiled a list of key priorities for enhancing coastal wetland protection, management and restoration, which are: (1) Prioritise productive protection, management, and restoration efforts, (2) Obtain and maintain adequate and targeted funding to protect and restore wetland ecosystem services, (3) Take a holistic, whole of system approach, (4) Halt degrading processes and direct impacts on coastal wetlands, (5) Simplify processes for protecting and restoring coastal wetlands on private land, and (6) Normalise the language of ecosystem services.

The issue of trade-offs proved contentious, with trade-offs generally being an issue where the provision of one ecosystem service is reduced as a consequence of the increased provision of another (see e.g. Howe et al., 2014), or when the provision of one or more ecosystem services is reduced as a consequence of a different land use (see e.g. Goldstein et al., 2012). Informants were in favour of decision-makers retaining direction to choose which ecosystem services to value over others, but were uncertain about how to effectively manage trade-offs between them, and whether the dollar value of services should factor into decisions regarding prioritisation. We conclude that an integrated framework for assessing ecosystem services will go some way towards ensuring that trade-offs are explicitly considered by decision-makers (consistent with Goldstein et al., 2012), but there may need to be conditions imposed to control the exercise of discretion, such as a requirement to consider both non-monetary and monetary benefits, and/or undertake consultation or seek expert advice. Our survey responses supported a need for continued research on how to navigate trade-offs (see e.g. Verhagen et al., 2018).

2. Methodology

Our interviews were based on the Delphi method of research (Linstone and Turoff, 1975), which is used most commonly in health sciences and 'is useful for research questions where the aim is to reach consensus from a field of experts, when there is no definitive "right" answer' (Wojcieszek et al., 2016, p 2). The conventional Delphi method involves a team designing a questionnaire, which is sent to a respondent group. After responses are received, the team analyses them, and develops a new questionnaire. This is then sent to the same respondents, who have an opportunity to revise their response/s (Linstone and Turoff, 1975). The exercise systematically attempts to provide a consensus of opinion, and identify any divergence (Strauss and Zeigler, 1975). The meaning of consensus is not universally agreed upon (von der Gracht, 2012), and previous Delphi studies have defined 'consensus' as > 70% (see e.g. Vogel et al., 2019) or > 75% (see e.g. Diamond et al., 2014; Santaguida et al., 2018) agreement. The staged process is intended to allow participants to reconsider their responses in light of other responses (Rayens and Hahn, 2000).

A Delphi study generally begins with open or semi-open questions (Brady, 2015) that 'generate ideas and allow participants complete

freedom in their responses. This helps to identify issues, which would be addressed in subsequent rounds' (Hasson, Keeney and McKenna, 2000, p 1011).

The optimal number of experts in a Delphi study is between 10 and 30 (Guglyuvatyy and Stoianoff, 2015). For our Delphi study we sought to recruit a small cohort of key informants (15−20) from across all Australian jurisdictions, including representation from the various state and federal government agencies involved in wetland protection, management and restoration, NGOs, science and academia. To recruit our informants, we used a combination of personal networks and government department enquiry forms and asked informants for suggestions of additional experts to approach. Round one of interviews involved sixteen informants, representing all Australian jurisdictions (Commonwealth, Queensland, New South Wales, Victoria, Tasmania, South Australia and the Northern Territory) with the exception of the Australian Capital Territory, as it has no coastal wetlands, and Western Australia, from which we were unable to recruit anyone. Of our 16 informants, 11 were from government agencies (including Departments responsible for land-use planning, environmental protection, and fisheries management), four were scientists employed at universities, and one was a scientist employed at an NGO. As the majority of Australian experts in wetland law and policy are employed within government agencies, we were satisfied with the breadth of experience of our informants.

An open-ended qualitative round is widely accepted and encouraged for the first round of a Delphi study (Singh et al., 2018; Canessa et al., 2022). Our first round of interviews was therefore designed to be purely open-ended to assist with identifying the range of relevant issues. We posed a single open-ended question to our informants (see e.g., Wojcieszek et al., 2016). This question was:

In your opinion, what (if any) are the current legal barriers to effective management, protection and restoration of mangroves and other wetlands?

We conducted these interviews in person or by phone in February 2020, and they were recorded and transcribed. The transcripts were then thematically analysed (see e.g., Braun and Clarke, 2006). Given the small number of informants we were able to identify these themes manually. We also used word cloud software to determine whether any keywords or issues were omitted, and we found no additional themes through using this.

This first round of interviews revealed a high degree of overlap in the issues identified by our informants, and responses could be easily clustered into five themes as set out in the results section of this paper.

The second round of interviews consisted of a targeted questionnaire aimed at eliciting more detailed and specific insights on these themes. We also posed questions regarding issues that were in dispute or unclear from the first round, and unexpected issues that were raised during the first round of interviews. To focus responses, we concluded by asking informants what they thought should be the key priority for wetland protection, management and/or restoration. The targeted questionnaire (see Supplementary Table 1) included a series of yes/no and open-ended questions, with the opportunity to add additional information if desired. Some informants also manually entered 'undecided' or circled both responses.

Informants were asked to either return written responses, or a time was scheduled to conduct an interview by phone. If the latter method was chosen, the interview was recorded and transcribed onto the questionnaire. Of the original 16 informants, 12 participated in round two, with responses gathered in August/September 2020. The remaining four declined to participate or did not respond to our requests. Of the 12 informants interviewed in round two, nine were from government agencies, two were scientists employed at universities, and one was a scientist employed at an NGO.

The results of the second round of interviews revealed a high level of consensus on most issues, and it was determined that a third round would not generate additional useful data (see e.g. McCarthy and

Table 1
List of key laws and policies relevant to wetland protection, management and restoration in Australia (as of early 2020 when the Delphi study interviews were conducted).

STATE	LEGISLATION	POLICY
Queensland	*Fisheries Act 1994* (Qld) *Planning Act 2016* (Qld) *Planning Regulations 2017* (Qld) *Coastal Protection and Management Act 1995* (Qld) *Nature Conservation Act 1992* (Qld) *Marine Parks Act 2004* (Qld) *Environmental Offsets Act 2014* (Qld) *Environmental Protection Act 1994* (Qld)	State Code 11 State Code 8 *Coastal Management Plan Strategy for the Conservation and Management of Queensland's Wetlands 1999 Environmental Protection (Water and Wetland Biodiversity) Policy 2019 Wetlands in the Great Barrier Reef Catchments Management Strategy 2016–2021*
New South Wales	*Fisheries Management Act 1994* (NSW) *Environmental Planning and Assessment Act 1979* *NSW *Coastal Management Act 2016* (NSW) *Marine Estate Management Act 2014* (NSW)	*Policy and guidelines for fish habitat conservation and management State Environmental Planning Policy (Coastal Management) 2018*
Victoria	*Planning and Environment Act 1987* (Vic) *Marine and Coastal Act 2018* (Vic) *Fisheries Act 1995* (Vic) *Flora and Fauna Guarantee Act 1998* (Vic) *Water Act 1989* (Vic) *Catchment and Land Protection Act 1994* (Vic) *Heritage Rivers Act 1992* (Vic) *Crown Land (Reserves) Act 1978* (Vic) *National Parks Act 1975* (Vic)	*Victoria Planning Provisions* [VPP] *Guidelines for the Removal, Destruction or Lopping of any Native Vegetation (2017) Marine and Coastal Policy (2020) Flora and Fauna Guarantee Strategy Victorian Waterway Management Strategy*
Northern Territory	*Planning Act 1999* (NT) *Environment Protection Authority Act 2012* (NT) *Environmental Assessment Act 1982* (NT) *Territory Parks and Wildlife Conservation Act 2006* (NT) *Fisheries Act 1988* (NT) *Water Act 1992* (NT) *Waste Management and Pollution Control Act 1998* (NT)	*Northern Territory Planning Scheme Land Clearing Guidelines (2019)*
Tasmania	*Land Use Planning and Approvals Act 1993* (Tas) *Living Marine Resources Management Act 1995* (Tas) *Water Management Act 1999* (Tas)	*Tasmanian Planning Scheme – State Planning Provisions (2017)*
South Australia	*Fisheries Management Act 2007* (SA) *Marine Parks Act 2007* (SA) *National Parks and Wildlife Act 1972* (SA) *Native Vegetation Act 1991* (SA) *Natural Resources Management Act 2004* (SA) *Adelaide Dolphin Sanctuary Act 2004* (SA) *Development Act 1993* (SA)	Template local plan
Western Australia	*Biodiversity Conservation Act 2016* (WA) *Environmental Protection Act 1986* (WA) *Planning and Development Act 2005* (WA) *Aquatic Resources Management*	State Planning Policy 2.9 *Wetland Conservation Policy for Western Australian 1997 Draft Guideline for the Determination of Wetland Buffer Requirements 2005*

Table 1 (*continued*)

STATE	LEGISLATION	POLICY
Commonwealth	*Act 2016* (WA) *Conservation and Land Management Act 1984* (WA) *Rights in Water and Irrigation Act 1914* (WA) *Environmental Protection and Biodiversity Conservation Act 1999* (Cth) + regulations *Water Act 2007* (Cth) *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth)	*Murray-Darling Basin Plan 2012 National Guidelines for Ramsar Wetlands*

Atthirawong, 2003; Nilsson and Weitz, 2019).

The study received ethical approval from the University of Queensland Business, Economics and Law Low and Negligible Risk Ethics Sub-Committee (approval number 2019002449). We de-identified all data and assigned each informant a random participant number (e.g. participant one = P1), by which they will be referred to in this article.

3. Results

The first round of interviews revealed five main themes which we used to structure our results: (1) integration of ecosystem services into decision-making frameworks, (2) trade-offs and cost benefit analysis, (3) land tenure issues, (4) future migration and sea-level rise and (5) restoration.

3.1. Integration of ecosystem services into decision-making frameworks

A significant topic of discussion in the interviews was the complexity of the decision-making, governance and political processes relevant to the protection, management and restoration of wetlands. For context, Table 1 provides a list of the key pieces of legislation and policy relevant to the protection, management and restoration of wetlands in Australia. This provides an insight into the sheer quantity of laws and policies in this space, a problem articulated by some informants.

Round one of interviews indicated that ecosystem services do underpin the practice of decision-making regarding coastal wetlands to some extent, but the degree of inclusion is not uniform across Australian states and territories – a finding that is perhaps not surprising given the wide variety of supporting laws and policies listed in Table 1. Some informants could not point to any explicit inclusion, and identified ecosystem services as being a more implicit consideration underpinning law and policy (P4, P5, P8), confirming our hypothesis that the ecosystem services concept may permeate practice more deeply than the state of written laws and policy would indicate.

Informants echoed some of the key findings of the earlier desktop study including that ecosystem services are more commonly included in policy rather than in law[1] (P1, P7, P9) and that even where ecosystem services are mentioned, it is generally not accompanied by a *requirement* to consider them in a formal or binding way (P7). It was also observed that ecosystem services management can be fragmented with single services regulated under different regimes (P15), with many respondents pointing to legal regimes to protect single services (e.g. fisheries value, cultural value, etc) (P1, P3, P6, P14, P2, P8).

Given that our informants confirmed that there are problems inherent in the current system for restoration, protection and management of coastal wetlands, our questions turned to future reform. In particular, further clarification was sought in round two of interviews

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[1] We use 'law' to refer to instruments made by Parliament (legislation and delegated legislation), with 'policy' being instruments made administratively: see e.g., Bell-James, Boardman and Foster (2020).

regarding the appropriateness of including acknowledgement of ecosystem services in legislative frameworks, as well as the existing barriers and the logistics of integrating the concept into these frameworks.

Question one of the questionnaire was 'should ecosystem services be an explicit requirement for decision-makers under legislation / policy?'. There was a high level of agreement, with 83% of informants selecting 'yes'. One informant further elaborated that although under current decision-making frameworks, 'most decision-makers already, perhaps unwittingly, consider ecosystem services', an explicit requirement would ensure 'sustained delivery of … the most diverse range of ecosystem services' (P11).

However the practicality of this was questioned; for example, while selecting 'yes' to question 1, P12 noted that this is perhaps easier said than done. P14, who answered this question in the negative, said their response reflected their opinion that current quantification methods are not sufficiently developed to enable effective consideration of services. Similarly, P4 answered 'no' and suggested that making consideration of ecosystem services an explicit requirement in decision-making may not lead to better outcomes for protection of wetlands, since it is difficult to identify the contribution of specific areas of wetland to ecosystem services.

If question one was answered in the affirmative, informants were then asked to answer question two, which was 'should this requirement be in legislation, policy, or both?'. A majority of informants stated that an explicit requirement to consider ecosystem services should appear in both legislation and policy (75%). P11 suggested that the concept should be enshrined in the general objectives section of legislation, while more detailed information about application of the concept should be located in policy documents (such as regulations and departmental policy). This echoed P16's opinion that legislation and policy instruments were both necessary components of the legislative framework, as policy would provide direction about the interpretation of legislation. One informant selected policy alone (P12), and remarked that this reflected the difficulty of effectively codifying the ecosystem services concept in legislation. Two informants answered 'undecided'.

We sought to determine whether informants perceived the volume of legislation and policy (as described in Table 1) as a problem, as hypothesised in our desktop study of the legal framework. Question four was 'Is the amount of legislation/policy relevant to coastal wetlands a barrier to effective protection and management?'. Two-thirds of informants said yes, and a third said no. One commented that 'the matrix of legislation is intimidating for anyone proposing to undertake works in coastal wetlands or the intertidal zone' (P11). In contrast, P4 said that it is not a barrier to protection and management, as the quality of legislation and degree of integration with regulations is more important than pure quantity.

Question five asked 'is there a need for integrated legislative/policy frameworks capturing all ecosystem services provided by a resource (e. g., fisheries value, coastal protection)?'. 66.5% said yes, 25% said no, and 8.5% were undecided, but many were sceptical about whether this is achievable. For example, P13 commented 'I'm not sure how integrated ecosystem services legislation and policy could work', and P14 said 'there is certainly a need for it, but whether it's realistic or not is another question'. P16 agreed with the need for an integrated framework, and suggested that it could specifically target positive environmental outcomes, and in their opinion rectify the amount of litigation arising from legislation not being fit for purpose (that is, for environmental protection purposes). P12 thought that there should not be an integrated framework as it would be hard to achieve due to definitional issues, at least in the short to medium term. Similarly, P4 thought an integrated framework may not be realistic because it would be difficult to garner the requisite community support to enact and implement such legislation. Thus the concerns about integrating management of coastal wetlands were not ideological but rather related to the feasibility of doing so.

Another issue commonly raised by informants in round one of interviews was that protection, management and restoration of coastal wetlands are complicated by the technical complexity created by competing, conflicting or superfluous legislation/policy documents, as well as differences between jurisdictions (and disconnect between federal/state/local laws) (P1, P8, P9, P12, P14).

Informants did not view the solution to this problem as straightforward. Some thought that each of the pieces of legislation existed to serve a particular goal, and removing some might cause more gaps in protection, although streamlining the process may be a positive step in removing complexities currently associated with the governance of coastal wetlands (e.g., P8).

Additionally, some informants identified that the technical complexity of incorporating ecosystem services in legislation is a barrier, specifically in relation to challenges in integrating legislation/policy with non-written information such as maps (P12, P15), and the complexity of 'methods' used to include consideration of ecosystem services. For example, the practical implementation of the Payments for Ecosystem Services ('PES') method may need to be better fleshed out to enable integration into the policy context (P9).

Some suggested that political will and/or the involvement of advocacy groups play a major role in whether or not ecosystem services are recognised or protected in legislation. For example, there has been strong advocacy for protection of fisheries and bird habitats, which has translated into robust protection of these services. Although this was viewed by some as a positive as 'protection is protection' regardless of the motivation, some suggested that it skewed trade-offs and did not always result in scientifically-driven decisions (P2, P8, P14, P16). It also means that services such as soil health, which do not attract the same lobbying efforts, may not be prioritised in decision-making, regardless of their importance (P14).

3.2. Trade-offs and cost-benefit analysis

3.2.1. Assessing trade-offs between different ecosystem services, and between ecosystem services and other land uses

In round one of interviews, the logistical difficulty of managing trade-offs between different ecosystem services (see e.g. Bennett, Peterson and Gordon, 2009) was identified by some informants as an issue. P1 highlighted the example of restoration projects involving the reconversion of farmland to saline wetlands, in areas where the influence of tides have been reduced by building bund walls to create pasture ('ponded pastures'). Restoration of tidal flow to an area may restore some ecosystem services, but also sacrifice existing services in the freshwater systems that developed as a result of a bund wall. Legislation requiring, for example, no net loss of a range of services, may not enable proper assessment of these types of projects at a granular level. Trade-offs between ecosystem services vis-à-vis other land uses (e.g. physical development, agriculture) was identified as another impediment to the inclusion of ecosystem services in law and policy (P2, P4, P5, P7, P14, P15).

Related to theme 3.1 above, some informants suggested it can be difficult to reduce scientific concepts to legislative form, and this may explain why ecosystem services are often found more commonly in policy, as this can enable the flexibility required to manage trade-offs (P1, P2). Other informants highlighted the difficulty of advocating for holistic consideration of services in legislation, as trade-offs may be inevitable (P3, P7). For example, P3 observed that identifying individual services in legislation may mean that the flow and interconnectedness of a system's benefits are not taken into account. As this emerged as a key theme in round one, in round two of interviews we sought to further interrogate informants on their views as to how trade-offs could be managed and addressed.

As a pre-cursor to this, we sought to understand which particular ecosystem services our informants thought were best recognised in current legal frameworks. To this end, question three asked informants

'what ecosystem service do you think currently receives the highest level of recognition and protection in wetland law/policy?', and they were given a choice between coastal protection, fisheries, water services, carbon sequestration, cultural services and other. The responses to this question were mixed, with no clear consensus regarding which ecosystem service receives the highest recognition and protection in wetland law and policy currently. Some selected multiple services. The most common answer was 'fisheries' (6 out of 12 informants), followed by water services (3 out of 12). Cultural services and coastal protection were each selected only once. Carbon sequestration was not selected by any informant, although both P9 and P14 remarked that carbon sequestration is likely to receive more recognition in the coming years as carbon farming initiatives become more common through the inclusion of wetlands in Australia's current emissions reduction framework (the Emissions Reduction Fund). Finally, three informants stated that there was either very little or no current recognition of ecosystem services in coastal wetland law and policy (P4, P9, P13). According to P13, this is due to a lack of advocacy for ecosystem services, compared to that for extractive industries like coal mining.

Questions Eight and Nine asked 'should legislation prioritise particular ecosystem services over others?', and 'should decision-makers have the discretion to choose which ecosystem services to prioritise over others?'. In response to question eight, two-thirds of informants thought that legislation should prioritise particular ecosystem services over others, but perhaps only for reasons of practicality (P9), and specifically to maximise public benefit (P5). This should also be accompanied by regular auditing to determine where ecosystem services are not valued and maintained, with perhaps opportunities for regulatory intervention (P13). Those who answered 'no' focused on the need for integrated policy and decision-making and a more holistic view of ecosystem services (P8, P11).

In response to question nine, 75% of informants agreed that decision-makers should have the discretion to choose which ecosystem services to prioritise over others. Extended responses emphasised the need for strong overarching policy and processes/guidelines to regulate discretion (P5, P16), embedded within an integrated approach that values ecosystems as a whole (P12). These guidelines should include things like 'improvement of the most degraded ecosystem services' (P9).

Both P8 and P13 expressed concern that discretion could make decision-making political, rather than science-based, and vulnerable to changes of government policy and/or leadership. Relatedly, P11 observed that the exercise of discretion may result in mere maintenance of the status quo, and protect only services with clearly identifiable financial benefits; it was suggested that the focus should instead be on maximising a variety of services, by maintaining and restoring ecological processes.

3.2.2. Utility of cost-benefit analysis in assessing trade-offs between different ecosystem services, and between ecosystem services and other land uses

The role of cost-benefit analysis in assessing trade-offs was raised by some informants in round one of interviews. For example, it was suggested that once there is an understanding that ecosystems provide tangible values, there must be some way of quantifying them so they can be comparatively valued relative to other land use options, such as clearing wetlands for physical developments and artificially constructed infrastructure (P10).

However, a cost-benefit analysis or financial valuation of ecosystem services was viewed by some informants as ethically problematic, with concerns raised about the ethics of monetising nature (P2, P15). Some informants also raised concern that the financial benefits of retaining or improving services may not outweigh that of development even when all ecosystem services are valued (P2). For example, wetland preservation or restoration may not be able to compete financially against potential developments on high value waterfront property (P2). One informant suggested that where data shows that the economic benefit of services

does not outweigh that of waterfront development, getting political support for wetland protection or restoration will be even more challenging (P4). There may also be difficulties in quantifying value; for example, in the context of cultural services such as fishing and camping spots, habitats for rare and threatened species, and other cultural values (P5, P14).

Other informants noted some instances where wetland preservation or restoration has a higher economic value than economic development. For example, Port Phillip Bay in Victoria provides numerous critical ecosystem services which outweigh any potential development value (P7). There was also an example given of water quality services linked to forests in the Melbourne catchment area: an environmental accounting exercise demonstrated that the value of the watershed forest in providing water filtration and a number of other services outweighed the potential value of the timber if it was logged (P10). This illustrates that in some circumstances a comparative economic valuation of ecosystem services against other land uses may fall in favour of protection or restoration of a coastal wetland.

Following on from 3.2.1, we sought to further interrogate whether there was utility in using cost-benefit analysis to compare different ecosystem services against one another, and against other land uses (e.g. physical development). If questions eight or nine (discussed above at 3.2.1) were answered in the affirmative, participants were invited to answer question ten, which asked 'should dollar value of protection/restoration project benefits vs other land uses be a consideration?'. Ten informants responded to this question, revealing no strong consensus and a significant degree of indecision: 60% of respondents said yes, 10% said no, but 30% were undecided or selected both options. Whilst this cohort of informants were generally in favour of discretion in managing different ecosystem services, it was not clear whether the dollar value of services should be a consideration in choosing which service to provide, and this question attracted the highest level of 'undecided' responses. The key reason for the uncertainty in responses seemed to be the difficulty in accurately articulating the dollar value of ecosystem services (P5, P6). P12 was undecided but suggested a middle ground: while dollar value should be taken into account, it should not be the 'sole criterion', as this approach would recognise that quantification has its limitations, but could 'help in making a broader case for restoration or protection'.

Informants who answered yes to questions eight or nine (discussed above at 3.2) were also asked 'do you have any other thoughts as to how ecosystem services should be prioritised in selecting sites for protection/restoration?' (question eleven). A diverse range of answers were given in response, with P12 noting the subjective nature of the topic. P14 suggested that any prioritisation concerns could be addressed by stacking services, where credits are sold individually, according to individual services, despite originating from the same site (Robertson et al., 2014), and P13 emphasised the need for assessments and risk frameworks. Overall, the power of financial valuation of ecosystem services was acknowledged, but many informants felt that non-market values were equally important and should be included in valuations.

3.3. Land tenure issues

Land tenure issues emerged as a major theme in round one of interviews, reflecting the position of coastal wetlands in the intertidal zone where land ownership is often unclear or contentious, and the location of wetlands may cut across multiple ownership regimes (P9, P11, P13).

On private land there may be issues with obtaining consent from adjoining landholders, as well as difficulties with access, and land use overlays imposed through planning laws (P2, P4, P7, P13). The traditional 'mean high water mark' boundary definition can be confusing (P11), and it may be difficult to discern exactly where the boundary between public and private land is located. Strategic land buy-backs could be used to facilitate projects (P16).

Some informants noted that, on public land, protection and

restoration activities can be undertaken more easily than on private land. However, the additional bureaucracy required for activities in highly protected areas of public land like national parks can be a barrier (P7). Some informants also spoke about the complexity of native title issues, and the need to include First Nations peoples in decisions regarding the management and use of coastal wetlands (P3).

Round two of interviews asked 'is wetland protection/management/ restoration easier on public or private land?' (question six) and 'do you have any additional thoughts on changes needed to land tenure arrangements to facilitate wetland protection/management/restoration?' (question seven). The response to question six was 75% public, 16.5% private, and 8.5% undecided. It was suggested that it is easier to compel compliance with legislative requirements on public land (P4, P14), but works may also involve more bureaucracy and community consultation requirements than those on private land (P8, P11). The intersection of a range of competing interests was identified by P12 as a barrier to wetland protection, management, and restoration on public land; P12 suggested that restoration of Ramsar sites is an example of works made difficult by this variety of interests. Comparatively, works on private land may be relatively easy if the landholder is amenable to them (P4, P8, P12), though compared to public land works these situations may be expensive, and potentially easily reversed by subsequent owners (P16), or changing priorities of a landholder (P6).

Question seven elicited a wide range of responses about the complex issues that arise in the context of land tenure and wetland management. Some informants highlighted the need for a shift in focus to hydrologic units as a whole (P11, P14, P16), rather than relying on lines drawn on maps (P14). P14 also observed that increased flexibility in land tenure arrangements is necessary to address changing hydrology, and to manage tenure in the intertidal zone. It was also suggested that specialised coastal wetland zones in planning instruments may facilitate protection, management, and restoration projects (P8, P9, P11). P9 suggested putting in place mechanisms (such as payments for ecosystem services) that incentivise protection, management and restoration (P9), while P5 thought that there should be compulsory registration of coastal wetlands on title (P5). Finally, P12 observed that managing issues with land tenure is so complicated because it is context dependent, with the appropriate course of action influenced by whether private landowners (and surrounding landowners) are willing to support or allow for works to occur on their property, and for public land, management depends on political will.

3.4. Future migration and sea-level rise

While management of coastal wetlands in response to sea level rise was clearly identified as an important issue in round one (P1, P2, P9, P11, P14), all strongly agreed that the legal frameworks in most jurisdictions do not adequately provide for these coastal processes to occur at present (P1, P9, P14), although some noted that ongoing and proposed reforms are considering this issue (P2). We did not seek further responses on this issue in round two.

3.5. Restoration

A strong theme that emerged in round one of interviews was the presence of gaps in the current legislative framework in relation to facilitating restoration efforts (P1, P2, P7, P9, P10, P11, P13, P14). This included requirements for extensive permitting prior to undertaking projects, the need for proponents to engage with complex development application requirements, and a lack of specialised codes and guidelines in relation to restoration (P9, P10, P13). The focus of the current framework was identified as protection of ecosystems (P1, P9), which can lead to a lack of prioritisation of the most productive sites for continued restoration efforts (P9). There is also a dearth of restoration policy, so proponents must engage with processes designed for development; however, these processes are not fit for purpose as they do not

allow for focus on the positive impacts of a project (P9). Many informants also emphasised the need for high level policy and guidance material as to how restoration can and should be done (P2, P7, P11, P13, P14).

There were some examples given of successful restoration projects, including those implemented in national parks where there is already strong protection for the location, and these projects have also been driven by activities of local land services groups (P2). P2 suggested that some examples of restoration projects led by local land services can be found in the Hunter estuaries area of New South Wales; one example of this is the Kooragang Wetland Rehabilitation Project, managed by Hunter Local Land Services. This also supports the assertion made that restoration projects are easier to perform on public land (P7). We did not pose any further questions regarding restoration in the second round of interviews.

3.6. Other key priorities for reform

To conclude round two of interviews, we posed a final open-ended question: 'what do you think should be the key priority for wetland protection/management/restoration?' (question twelve). The object of this question was to supplement the interview results with a focused list of priorities for reform. These key priorities identified by our informants are discussed below.

3.6.1. Prioritise productive protection, management, and restoration efforts

The most common theme raised by informants was the need for prioritisation to ensure that protection, management and restoration efforts are as productive as possible. Protection should target areas where coastal wetland services remain, rather than areas where large proportions of wetland services are already lost (P5), and this prioritisation must consider future changes to coastal wetland ecosystems as a result of climate change (P6). P9 suggested that mapping coastal wetland condition to quantifiable ecosystem services would foster productivity and assist with prioritisation. One example of why prioritisation is necessary was identified by P11, who observed that national disaster funding often supports replacing damaged infrastructure to its previous condition, however this may not support the long-term productivity of the system, meaning that it may not be the most efficient use of resources.

3.6.2. Obtain and maintain adequate and targeted funding to protect and restore wetland ecosystem services

P1 identified that a key priority should be developing a properly funded mechanism that is based on ecosystem services and a whole-of-system approach, and P5 suggested that this funding should be targeted to bioregions which are under threat but have limited current funding. In terms of what should be funded, P13 suggested that funding should extend to creating wetland stewardship agreements in priority areas so that efforts are specific to each wetland and fit for purpose.

3.6.3. Take a holistic, whole of system approach

Another common theme in responses concerned the importance of protection, management and restoration efforts being holistic (P1). On this point, P8 emphasised that ecological integrity should be prioritised in order to support self-sustaining ecosystems.

3.6.4. Halt degrading processes and direct impacts on coastal wetlands

Halting degrading processes that cause direct impacts on wetlands was identified as a key priority by both P4 and P11. For example, P11 identified floodplain drainage infrastructure as a phenomenon that has seriously impacted coastal wetlands, and has traditionally also attracted public funding. Halting this type of interference would contribute to the protection of coastal wetlands.

3.6.5. *Simplify processes for protecting and restoring coastal wetlands on private land*

P11 acknowledged that halting degrading processes that impact wetlands is directly linked to being able to regulate coastal wetlands owned by private landholders. Therefore wetlands or future wetland sites on Crown land (i.e. owned by government) should not be sold to private landholders without clear rehabilitation management plans in place. P14 also identified the management of coastal wetlands on private property as a key priority, particularly since many future high value sites are privately owned.

3.6.6. *Normalise the language of ecosystem services*

Finally, P12 suggested that developing the language of ecosystem services should be the key priority, to properly normalise the ecosystem services concept for productive discussions about it in the public sphere.

4. Discussion and conclusions

Our earlier desktop study found a lack of integration of the ecosystem services concept into written law and policy. Our Delphi study sought to test whether this is a problem in practice and if so, generate insights as to how law reform should occur and what the key priorities should be. Our Delphi study revealed a strong consensus that the lack of integration of ecosystem services into legislative and policy frameworks contributes to the gap in the protection, management and restoration of coastal wetlands. This echoes findings of other studies that have demonstrated that integrating ecosystem services into land use planning law and policy provides a quantitative way for decision-makers and stakeholders to consider the environmental and economic implications of proposed decisions (Goldstein et al., 2012; García-Llorente et al., 2018; Keenan, Pozza and Fitzsimons, 2019; Mikša et al., 2020). Consistent with our desktop study (Bell-James, Boardman and Foster, 2020), the first round of interviews revealed that there are rarely requirements to consider ecosystem services in any formal or binding way (that is, as a requirement for development consent) in current Australian legal frameworks. In the second round of interviews, there was significant consensus support for making ecosystem services an explicit requirement in legislation and policy. However, the solution is far more complicated than simply including references to ecosystem services in legislative frameworks, and one approach that received majority support was prioritisation of ecosystem services in decision-making, while still retaining decision-makers' discretion in this process.

Many informants were concerned that the high quantity of legislation and policy was a barrier to effective protection, management, and restoration of coastal wetlands, and expressed a preference for an integrated regulatory framework. This is consistent with the literature on integration in the coastal zone (see e.g. Cicin-Sain, 1993) and forestry management (see e.g. Sotirov and Arts, 2018). However the results also suggest that a completely integrated framework (e.g. a single piece of legislation) may be impossible to achieve in current policy settings, but greater cohesion across the suite of instruments would assist with increasing effectiveness (see literature on policy coherence: e.g. Nilsson et al., 2012). For example, this could be achieved through legislated requirements for decision-makers to consider a range of ecosystem services provided by a wetland in making a decision that may impact on it.

Whilst our interviews revealed no single key priority for coastal wetland protection, management, and restoration going forward, the variety of responses on this issue perhaps reflects individual informants' particular knowledge bases and areas of work rather than major points of disagreement. Thus we did not view this as a lack of consensus requiring a further round of interviews. The most commonly identified priority was the importance of prioritising productive intervention efforts. This supports calls for further research into methods for prioritising cost-effective or high value projects, especially in the restoration space, and in light of coastal wetland landward migration and future changes as a result of climate change (see e.g. Shoo et al., 2021;

Shumway et al., 2021).

The complexities of protecting, managing and restoring coastal wetlands across a variety of land tenures emerged as a key issue in our interviews. The majority of our informants suggested that wetland protection, management and restoration is easier on public land than it is on private (75%). This is consistent with the literature which highlights the need for voluntary participation and incentives for projects on private land (see e.g. Fitzsimons, 2015; Welsh, Webb and Langen, 2018; Bell-James et al., 2021), and supports the role of ecosystem services framing in promoting this (Matzek, Wilson and Kragt, 2019). This finding may also have significant implications for selecting sites for wetland restoration. Some informants flagged the resolution of land tenure issues as a key priority to address going forward and a rich area for further research.

Though our questions maintained a broad focus on wetland protection, management, and restoration in both rounds one and two of interviews, restoration of coastal wetlands emerged as the main challenge faced by several informants. This is consistent with literature highlighting the urgent need for restoration activities in the coastal zone (see e.g. Bayraktarov et al., 2020; Saunders et al., 2020; Shumway et al., 2021). The challenges raised by informants specific to restoration included the lack of clarity around tenure and associated regulatory requirements, and the potential for trade-offs between existing services and those being re-established. This finding aligns with the existing literature on restoration, which has identified technical barriers to marine restoration projects including cost and a lack of fit-for-purpose policy (e.g., Shumway et al., 2021; Bayraktarov et al., 2020). Whilst not a panacea for all these challenges, the integration of ecosystem services into restoration decision-making has been identified as a factor that may facilitate project uptake (see e.g. Matzek, Wilson and Kragt, 2019).

Our interviews revealed that trade-offs and the utility of using financial cost-benefit analysis to make decisions regarding ecosystem services is a major issue that will need to be carefully addressed in any law reform efforts. Whilst a majority of informants were in favour of decision-makers having discretion to choose which ecosystem services to prioritise (Q9), the question of whether the dollar-value of ecosystem services should form part of that decision-making process attracted the greatest amount of undecided responses (30%). This uncertainty perhaps reflects the concerns expressed in the literature about the ethics of monetising nature (see e.g. Hahn et al., 2015; Jax et al., 2013; Luck et al., 2012), including the difficulty of representing some services, such as cultural services, in financial terms (see e.g., Platjouw, 2019; Himes-Cornell et al., 2018; Wright et al., 2017). We determined that a third round of interviews on this point would be unproductive, as the literature suggests that the Delphi method may not be appropriate when dealing with the topic of trade-offs as decision-makers are affected by their own values and perceptions (Nilsson and Weitz, 2019). Thus it may be impossible to reach consensus. Instead, this flagged an issue that law and policy-makers will need to be mindful of in future law reform.

There is some literature to suggest that policy integration can lead to better identification of policy conflicts and assist with decisions regarding trade-offs (see e.g. Sotirov and Arts, 2018; Nilsson and Weitz, 2019), so some of the informant's concerns regarding trade-offs may be addressed by better integration of laws and policies, as discussed above. The concerns regarding trade-offs and financial valuations may also be alleviated if decision-maker's discretion is subject to constraints, which may include requiring a decision-maker to consider both financial and non-financial benefits in decision-making, or to obtain expert advice or undertake community consultation in making decisions (see e.g. Turkelboom et al., 2018).

The study involved a small sample of 16 informants and we acknowledge that, had a larger sample been surveyed, results may have varied. All informants had a high level of knowledge and competency regarding ecosystem services law and policy, which was deemed necessary for the type of information we were attempting to obtain.
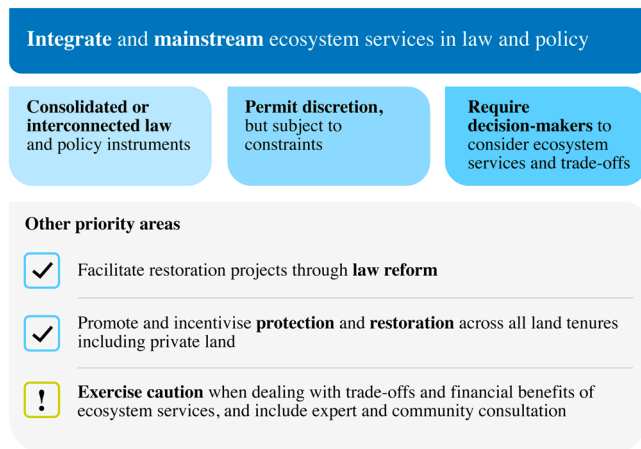
Summary of Results

Fig. 1. Key priorities for law and policy reform.

Thus, while our sample size was small, this was necessary due to the degree of skill and specialisation we sought from our informants, and we are confident that we surveyed a representative cross-section of the array of practitioners and experts working in this field in Australia. The close agreement amongst our group of informants also provides high confidence in the results.

Further, we acknowledge that the majority of our informants were from State and Federal government departments, but this was considered appropriate due to the majority of experts in wetland law and policy in Australia being located in government. Fig. 1.

5. Conclusion

Our Delphi study of key informants in the Australian coastal wetland management space confirmed that the ecosystem services concept is poorly integrated into law and policy for coastal wetland protection, management and restoration. We sought to investigate whether and how the law can be reformed to address this deficiency and our study indicated a clear appetite for law reform with greater integration and holistic management of ecosystems, as well as further research needed into managing ecosystem services across different land tenures and facilitating restoration projects. Issues of managing trade-offs and prioritisation remain difficult to resolve, but greater integration of law and policy would facilitate the crucial first step of ensuring that these trade-offs are made explicit to decision-makers and therefore taken into account in decision-making processes.

CRediT authorship contribution statement

Justine Bell-James: Conceptualization; Data collection; Funding acquisition; Investigation, Methodology, Writing – original draft, Writing – review & editing. **Rose Fosterb:** Conceptualization, Data collection, Investigation, Methodology, Writing - original draft, Writing – review & editing. **Catherine E. Lovelock:** Conceptualization, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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