

CONTRIBUTED PAPER

Rolling covenants to protect coastal ecosystems in the face of sea-level rise

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Abstract

This article considers how “rolling covenants” (i.e., covenants on land title that can operate in a “rolling” geographic area to keep pace with sea-level rise) can be used to permit productive use of land in the short term, while ensuring land use can shift over time to allow for coastal ecosystem migration in the medium to long term. We use Australia as a case study, and through analysis of legislation and a series of semistructured interviews, we demonstrate how land title-based covenants can be used to give legal effect to “rolling covenant” arrangements where land is subject to existing use and occupation. We then consider practical issues associated with drafting a rolling covenant arrangement, including an analysis of the types of events or scenarios that could be used as a basis for land use changing (e.g., projected sea-level rise, actual ecosystem migration), and the advantages and disadvantages of each. We conclude that rolling covenants are a viable option for land management in the coastal zone, especially in circumstances where funding sources are available to incentivize uptake. Rolling covenants may provide opportunities for coastal wetlands to be maintained and even enhanced in cover, thereby delivering important ecosystem services (e.g., blue carbon) into the future.

KEYWORDS

covenants, coastal ecosystems, coastal squeeze, sea level rise, rolling covenants, wetlands

1 | INTRODUCTION

As sea levels rise, some coastal ecosystems such as saltmarsh and mangroves will need to migrate inland to keep pace with rising seas. Where hard structures prevent this natural migration, these wetlands may be lost through a process known as “coastal squeeze” (see, e.g., Leo, Gillies, Fitzsimons, Hale, & Beck, 2019; Mills et al., 2016; Pontee, 2013). Setting aside areas to accommodate future landward migration has therefore become an important area

of research (Boston, Panda, & Surminski, 2020; Rogers et al., 2016) and in some instances, has translated into government policy; for example, the European *Natura 2000* sites often contain requirements to restore habitat where it is lost to the sea (see, e.g., Pontee, 2013). In Australia, the Tasmanian State Government has provided for the mapping of “future coastal refugia areas” to ensure land remains available for future wetland migration (see, e.g., Prahalad, Whitehead, Latinovic, & Kirkpatrick, 2019). However, these planning regulations

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will only apply to new developments and do not affect landholders retrospectively.

The objective of this article is to explore whether “rolling covenants” can be used in Australia to balance the need for long-term conservation of land for future coastal wetland migration with shorter-term opportunities for land use. In the Australian context, land title-based covenants are generally defined as legal obligations affecting landholders (Butt, 2010) and can be distinguished from contracts on the basis that the benefits and burdens attach to land, rather than to private parties. A covenant generally applies to a fixed spatial area, but here we consider whether a covenant can operate in a “rolling” geographic area to keep pace with sea-level rise. We first analyze whether existing legislative arrangements for land title-based covenants can be used to facilitate rolling covenant arrangements, and find that, in all jurisdictions, existing legislation is suitable for this purpose. We then consider the practical issues associated with drafting a rolling covenant arrangement, including what events or scenarios (termed “triggers” in this article) should be used as a basis for changing the land use (e.g., projected sea-level rise, actual ecosystem migration), focusing on existing uses and occupation of land. Finally, we conclude that rolling covenants in Australia present a viable opportunity for coastal wetlands to be maintained and enhanced into the future. While Australia has been used a case study herein, we also anticipate that similar arrangements could be utilized in other countries, subject to their unique legal arrangements.

2 | THE POTENTIAL ROLE OF ROLLING COVENANTS IN AUSTRALIA

Covenants have been used extensively in Australia to protect land in a fixed spatial area. One of the primary mechanisms used to permanently protect ecosystems on existing holdings of private land in Australia are conservation covenants, which are entered into by agreement (Fitzsimons & Carr, 2014). Conservation covenants are the most common form of privately protected area (PPAs) in Australia and, with over 5000 individual covenants qualifying (Fitzsimons, 2015), Australia has one of the largest PPA networks in the world (Bingham et al., 2017; Bingham, Fitzsimons, Mitchell, Redford, & Stolton, 2021). Although conservation covenants are known to play an important role in protecting ecosystems not well represented in the reserve system (e.g., Archibald et al., 2020; Fitzsimons & Wescott, 2001) and ecosystem services (Archibald et al., 2021), they have not been used extensively in coastal lands that fringe estuaries and oceans

(McCristal, 2015; Rogers et al., 2016). This is in part because a large proportion of coastal lands (currently) occur on public land in Australia, and the boundary between public and private ownership is often unclear (Bell-James & Lovelock, 2019). As sea levels rise and the suitable area for occupancy pushes inland and into private land or if tidal barriers that protect private land are removed, conservation covenants could provide an important mechanism (along with planning schemes, financial incentives, and voluntary land acquisition) to allow for land uses that assist coastal wetland migration (Fitzsimons, Hale, Hancock, & Beck, 2015).

Given the comparatively long timeframes (50–100 years) (IPCC, 2019) associated with the materialization of sea-level rise impacts compared to typical management planning (5–10 years), protecting land and/or restricting land use for future coastal migration in the short term may deprive landholders of the productive use of their land. A potential solution could allow a landholder to use the land on a time-limited basis, and when a trigger occurs (either due to the passage of a specified amount of time, or when the shoreline retreats to a particular distance), then land use close to the new coastal position would revert to conservation.

This type of arrangement reflects the “rolling easement” concept, which originated in the United States as an alternative to completely prohibiting shoreline development in the short term, but allowing the shoreline to encroach landward in the longer term (O'Donnell, 2014). Titus (2011, p. 7) described these instruments as “a legally enforceable expectation that the shore or human access along the shore can migrate inland instead of being squeezed between an advancing sea and a fixed property line or physical structure.” In this respect a rolling easement does not necessarily restrict land use, but rather prevents shoreline armoring to allow for natural coastal processes to occur. The purpose of a rolling easement is to allow flexibility in land use, so that land can be used productively until such time as it is threatened by the sea. This flexibility is an advantage over other approaches such as acquisition of land, which could be both expensive and deprive a landholder of productive use of land in the short to medium term. Despite there being a great deal of information on the importance of coastal ecosystems for their ecological and ecosystem service benefits, there is a dearth of explicit legislation, policies, and examples of on-ground projects that allow for the migration of coastal ecosystems in response to sea-level rise (Leo et al., 2019). Despite significant interest in similar arrangements in jurisdictions like the United States (and legislation such as the Texas *Open Beaches Act* and Maine's *Coastal Sand Dune Rules*), there are not yet examples of privately created setbacks being

triggered in practice (M.-C. Stiff, personal communication, Wetlands Watch).

The concept has been considered in Australia (e.g., O'Donnell, 2014; O'Donnell & Gates, 2013), although “easement” has a different legal meaning in Australia, and a covenant is the more appropriate legal mechanism to use. However to date, the concept of time-limiting development for shoreline preservation purposes has not been widely embraced in Australia (see, e.g., Productivity Commission, 2012; O'Donnell, 2014), and there has been little support from communities and landholders for instilling such policies into state and local government planning schemes (see, e.g., Verschuuren & McDonald, 2012). This reflects a broader reluctance within Australia to restrict development in the face of climate change, due to a history of strong protection of private property rights, and a preference for hard shoreline armoring techniques (see, e.g., Bell, 2014), that is exacerbated by the potential for landholders to seek compensation from governments where land values are reduced by virtue of planning reform (Fletcher et al., 2013).

Within this broader sociopolitical context, there are some examples of Australian governments balancing short-to medium-term land uses with accommodation of long-term coastal processes through planning law. For example, Byron Shire Council on the New South Wales north coast previously had a “planned retreat” policy embedded in its planning scheme, whereby coastal land was divided into three different zones, depending on the temporal scale of likely impacts (Byron Shire Council, 2010). Generally, physical development on land at risk in the shortest term would only be permitted where structures were temporary and readily removable. No developments would be approved within 20 m of the erosion escarpment (Byron Shire Council, 2010). In areas where projected risks were likely to materialize further in the future, planned retreat applied. Development approval for any new structure would only be given on the understanding that the building must be relocated or demolished, or the land use must cease, if the erosion escarpment retreats to within 50 m of the structure (Byron Shire Council, 2010). This obligation was required to be secured by a condition of development consent, effectively time-limiting the approval to the point in the future when the specified “trigger” event occurred (see, e.g., England, 2013). However, the Council has indicated its intent to move away from this policy (Bell, 2014) and its future is uncertain.

A planned retreat policy is also gaining some traction in the state of Western Australia. Under *State Planning Policy 2.6*, new development is required to make allowance for coastal processes like erosion and inundation to occur, with a planning timeframe of 100 years from the time of project assessment. This Policy was recently

considered by the Western Australian State Administrative Tribunal in the context of the assessment of a new local plan for an area north of Perth, intended to house a population of 27,000 along with associated infrastructure. Evidence presented to the Tribunal indicated that the coastline is likely to move approximately 170 m landward over the subsequent 100 years. The developers argued for a planned retreat approach to be adopted, to allow for the beneficial use of this zone in the interim. The Tribunal held that development could occur subject to planned retreat: once the shoreline retreated to within 40 m of the development, physical structures had to be removed and land rehabilitated (*Two Rocks Investment Pty Ltd v Western Australian Planning Commission*).

While these two examples may go some way towards preserving the shoreline in *new* developments, an arrangement to surrender *existing* use and occupation of land would require consent of the landholder. Although Crown ownership up to the mean high water mark will likely migrate inland with sea-level rise (see, e.g., O'Donnell & Gates, 2013), a landholder will not necessarily be required to abandon lawful use and occupation of land that would otherwise fall on the landward side of a tidal boundary. In this situation, coastal ecosystems may be physically “squeezed” out of the landscape (see, e.g., Mills et al., 2016) unless a private arrangement is made to ensure that land is available for future inland migration of coastal ecosystems. In this article, we seek to determine whether private land-based covenants are a viable tool that may be used in this scenario to secure objectives similar to those of rolling easements, with the consent of a landholder. That is, whether a private land covenant could be drafted to allow for a permitted land use to continue for a period of time, but subsequently be prohibited or restricted upon occurrence of a specified trigger (a “rolling covenant”).

3 | METHODS

We undertook a detailed desktop survey of all legislation across Australian states which permits the creation of land title-based covenants. We obtained a list of all relevant legislation through targeted searches of legislative databases (e.g., the Australasian Legal Information Institute: <http://www.austlii.edu.au/>) using terms such as “covenant” and “conservation agreement.” We then cross-referenced this list against earlier studies of conservation covenants in Australia (e.g., Archibald et al., 2021; Fitzsimons, 2015). Once this list was compiled, we analyzed and summarized the legislative requirements of all relevant instruments (see Table 1).

Following our review of the legislation summarized in Table 1, we verified our understanding through

TABLE 1 Summary of covenant legislation in Australia

State/territory	General – managed by Land Titles Registry	Specific category (e.g., nature conservation focused)
Queensland	<i>Land Title Act 1994</i> <ul style="list-style-type: none"> • Covenantee must be govt entity • Must relate to “use of the lot,” which includes preservation of native plants and natural heritage 	<i>Nature Conservation Act 1992</i> <ul style="list-style-type: none"> • Administered by Department of Environment and Science • Nature Refuge underpinned by conservation agreement • Can restrict land use and management • A nature refuge must be managed to conserve natural and cultural resources • Binds successors • Financial assistance may be available
New South Wales	<i>Conveyancing Act 1919 and Real Property Act 1900</i> <ul style="list-style-type: none"> • Government authorities can impose restrictions on land via a covenant • Not registered, but binds successors in title 	<i>Biodiversity Conservation Act 2016</i> <ul style="list-style-type: none"> • Administered by the Biodiversity Conservation Trust (BCT) • Allows conservation covenants between the BCT and a landholder, for the purpose of conserving or studying the biodiversity of the land • Underpinned by a conservation agreement which may require the owner to refrain from, or carry out, specific activities • Registered on title and binds successors • Financial assistance may be available <i>National Parks and Wildlife Act 1974</i> <ul style="list-style-type: none"> • Administered by the Minister for Energy and Environment • Allows conservation agreements with owners of land containing scenery or natural environments worthy of preservation • Registered on title and binds successors
Victoria	n/a	<i>Victorian Conservation Trust Act 1972</i> <ul style="list-style-type: none"> • Administered by Trust for Nature (“TFN”) • TFN can enter into covenants with landholders, including where land is ecologically significant or important for the conservation of wildlife or native plants • Recorded on title and binds successors • Financial assistance may be available <i>Conservation, Forests and Lands Act 1987</i> <ul style="list-style-type: none"> • Administered by the Department of Environment, Land, Water and Planning • Allows agreements with landholders relating to the management, use...conservation of land • May be registered and bind successors <i>Planning and Environment Act 1987</i> <ul style="list-style-type: none"> • A “responsible authority” may enter into an agreement with a landholder to restrict the use or development of land • Registered on title and binds successors

TABLE 1 (Continued)

State/territory	General – managed by Land Titles Registry	Specific category (e.g., nature conservation focused)
South Australia	n/a	<p><i>Native Vegetation Act 1991</i></p> <ul style="list-style-type: none"> • Administered by the Department for Environment and Water • Department and landholder can enter into a Heritage Agreement to provide for the preservation or enhancement of native vegetation on land • The Agreement may include provisions restricting use of land, and providing for the management of land • Attaches to land and binds successors • Financial assistance may be available <p><i>Planning, Development and Infrastructure Act 2016</i></p> <ul style="list-style-type: none"> • An authority may enter into land management agreements with landholders regarding the management, preservation or conservation of land • Registered on title and binds successors
Western Australia	<p><i>Transfer of Land Act 1893</i></p> <ul style="list-style-type: none"> • Covenants can be entered into between governments and landholders, and notified on title • Can bind successors in title if covenant states as such 	<p><i>National Trust of Australia (WA) Act 1964</i></p> <ul style="list-style-type: none"> • Administered by the National Trust WA • May enter into a covenant with a landholder whereby land is made subject to conditions restricting the planning, development or use of land • May be registered on title and binds successors <p><i>Biodiversity Conservation Act 2016</i></p> <ul style="list-style-type: none"> • The Minister for Environment may enter into biodiversity conservation agreements with owners or occupiers of land for purposes including: facilitation of the ecologically sustainable use of biodiversity, mitigation of activities that may impact on biodiversity, and promotion of biodiversity conservation • Registered on title and binds successors <p><i>Soil Conservation Act 1945</i></p> <ul style="list-style-type: none"> • The Commissioner of Soil and Land Conservation may enter into a covenant with a landholder requiring them to set aside land for the protection and management of vegetation • Registered on title and binds successors <p>(see also <i>Carbon Rights Act 2003</i> and <i>Waterways Conservation Act 1976</i>)</p>
Tasmania	n/a	<p><i>Nature Conservation Act 2002</i></p> <ul style="list-style-type: none"> • Administered by the Tasmanian Department of Primary Industries, Parks, Water and Environment • May enter into a conservation covenant with a landholder if necessary for a “conservation purpose” (includes conservation of natural biological diversity)

(Continues)

TABLE 1 (Continued)

State/territory	General – managed by Land Titles Registry	Specific category (e.g., nature conservation focused)
		<ul style="list-style-type: none"> Registered on title and binds successors Some local government financial assistance may be available <p><i>Land Use Planning and Approvals Act 1993</i></p> <ul style="list-style-type: none"> A local government may enter into an agreement with a landholder regarding, amongst other things, the restriction of land use Agreements are capable of registration and will bind successors in title
Northern Territory	<p><i>Land Title Act 2000</i></p> <ul style="list-style-type: none"> Widest covenanting legislation in Australia May be created by any parties, for any purpose Registered on title and binds successors 	<p><i>Territory Parks and Wildlife Conservation Act 1976</i></p> <ul style="list-style-type: none"> Administered by the Territory Parks and Wildlife Commission Can negotiate and enter into agreements with private landholders regarding the protection and conservation of natural features of land Registered on title and binds successors

semistructured interviews with the major conservation covenanting bodies in three jurisdictions with established covenanting programs to determine whether these arrangements had been used before, and if not, whether they would be practically feasible (i.e., Trust for Nature [Victoria] in Victoria, Biodiversity Conservation Trust in New South Wales, Queensland Trust for Nature in Queensland).

4 | RESULTS

In Australia, arrangements for the creation and enforceability of covenants are made at the state and territory government level, and differ considerably across these jurisdictions (Archibald et al., 2020; Bell, 2014; Fitzsimons & Carr, 2014). In some jurisdictions, land titles or property law legislation makes provision for the registration or recording of covenants generally, and allows covenants to be used in a broad range of legal circumstances. All jurisdictions also have specific legislation, often conservation-focused, which allows for the registration or recording of particular types of agreements (collectively known as conservation covenants).

The review of legislation summarized in Table 1 indicated that there are no barriers in existing legislation for the creation of covenants for “rolling covenant” type arrangements in all coastal jurisdictions. In particular, there are no explicit prohibitions on drafting covenant clauses to temporally constrain land use; that is, to allow a

land use to continue for a period of time, and then cease or change upon the occurrence of a specified trigger.

In jurisdictions where property law allows for generic covenants to be registered or recorded (e.g., Queensland, the Northern Territory), this may be the most useful option for rolling covenant arrangements. The covenants can be used for a broad range of purposes in Queensland, as they need only pertain to the use of the land, and in the Northern Territory they may be used for any purpose. In jurisdictions where covenants are permitted for a particular purpose (e.g., the *Biodiversity Conservation Act 2016* in New South Wales), the subject matter of the covenant may need to align with the purposes of the legislation (e.g., conserving biodiversity) and also the objectives of the entity administering the legislation. The terminology in all specific legislation in Table 1 is broad enough to encompass a rolling covenant arrangement, provided the purpose of the covenant is expressed as allowing for natural habitats to migrate/establish/reestablish as sea level rises. For example, a rolling covenant could be used under the *Victorian Conservation Trust Act 1972* in Victoria to conserve saltmarshes of southern and eastern Australia because of their high conservation status (e.g., being listed as an vulnerable ecological community under the *Federal Environment Protection and Biodiversity Conservation Act 1999*)—this would align with the land being “important for the conservation of wildlife or native plants.”

Our semistructured interviews with covenanting bodies indicated that, to date, conservation covenants have

mostly been used to restrict land use immediately, in perpetuity, and in its present location—for example, a landowner may agree to leave an area of land vegetated and undeveloped. Covenants have not yet been used in the “rolling covenant” sense; that is, to systematically constrain land use over different temporal scales. However, these covenanting bodies also agreed that there is no reason in principle why existing legislation cannot be used to create a rolling covenant-type arrangement in the future.

5 | DISCUSSION

While using covenants to secure different land uses in distinct temporal spheres is technically possible, and could therefore facilitate rolling covenant type arrangements, there are some practical issues to consider. The main issue is how to express restrictions on land use that do not come into effect until some point in the future (see section 5.1). Additionally, our discussions with major covenanting bodies in Australia also indicated that the practicalities of implementing a rolling covenant might be different to usual covenants for several reasons, including (a) the covenant may include requirements to carry out action in the future (e.g., moving fencing), which will require positive obligations to be performed across long time scales; (b) the funding arrangements may be unusual as they are tied to future action; (c) there may be issues with enforcement, and; (d) there may be problems with weeds forming in non-natural habitats. However, there are also potential solutions to these problems: for example, existing conservation covenants are accompanied by management plans that address similar issues (Fitzsimons & Carr, 2014). As with most other forms of conservation covenants in Australia, it is envisaged that rolling covenants would be entered into primarily on a voluntary basis with either targeted approaches by the covenanting agency to the landholder or the landholder approaching the covenanting agency.

5.1 | Defining the covenant zone

The key objective of a rolling covenant arrangement will be to allow a specified land use in the short term, but then require this land use to be altered on the occurrence of a trigger. Depending on the circumstances, this trigger may also require the landholder to carry out defined positive actions (e.g., removing or relocating fencing). There are a number of different options for expressing this trigger, each with its own risks and benefits. We discuss

three options in turn below, although acknowledge that other options or mechanisms could also be effective.

5.1.1 | Projected sea-level rise mapping

One option for implementing rolling covenants on coastal land is to use existing national or state mapped projections of sea-level rise (e.g., <https://www.climatechangeinaustralia.gov.au/en/climate-projections/>) to delineate areas of land likely to be inundated at certain time periods (e.g., 2050 or 2100), perhaps with an additional buffer incorporated to allow for uncertainty and the occurrence of more severe impacts than projected (see Figure 1b). These different areas then form the covenant “zones.” For example, a covenant may state that the landholder can use the entirety of the covenant land (zones one and two) for any lawful purpose (e.g., agriculture) until 2050. In 2050, the landholder will have to cease any use of the land between the Highest Astronomical Tide line and the 2050 line (zone one) that impedes ecosystem migration (e.g., agricultural grazing), and may be required to move any fencing to the landward side of the projected 2050 inundation line. Lawful uses including agricultural grazing can continue to occur landward of the 2050 line (zone two).

The potential benefits of using projected sea-level rise mapping are that the projections already exist and the covenant triggers and temporal zones of use can therefore be defined relatively easily. A trigger tied to a date (e.g., 2050) also gives landholders a definitive timeframe for planning what could be large changes to the use of their properties, giving both landholders and the covenanting agency certainty and security.

However, this approach also has some limitations. In particular, it does not allow for the unhindered migration of ecosystems landward in that period. Sea-level rise and ecosystem migration will occur in a gradual manner, and it is not able to be accurately predicted with complete certainty. Where the trigger for a change of use zone is set far into the future (e.g., 2050 or 2100) there is a possibility that significant change could occur prior to the trigger occurring. For example, in the period between the present day and 2050, the shoreline may retreat inland into Zone One of the covenant land (Figure 1b), but vegetation will potentially be “squeezed” out of the landscape if hard barriers are present or agricultural uses continue (e.g., Mills et al., 2016). On the other hand, the trigger may turn out to be too expansive, with actual sea-level rise being of a lesser magnitude than projected at the specified date. This will in turn lead to land in Zone One that is not occupied by coastal vegetation but also not available to agriculture post the trigger period (e.g., 2050).

The continued use of areas immediately adjacent to coastal ecosystems could also limit the ability of systems to naturally regenerate. For example, there is evidence that the landward edge of mangroves and saltmarshes have a limited capacity for natural regeneration where cattle are present (even at reduced stocking densities) as a result of trampling and grazing (Minchinton, Shuttleworth, Lathlean, McWilliam, & Daly, 2019; Rogers et al., 2016; Ross, 2006; Wasson & Woolfolk, 2011), in which case some active intervention might be necessary. There is also potential for weeds (particularly pasture weeds in grazing country) to form or proliferate in the area between coastal vegetation and the outer boundaries of a temporal zone of use if sea-level rise does not result

in landward inundation to the extent that the modeling predicted.

5.1.2 | Property scale mapping (high resolution in space and time)

An alternative to the use of broad-scale sea-level rise mapping is more fine-scale mapping undertaken for individual properties, taking into consideration estuarine and landscape features that may modify future sea levels (e.g., tidal attenuation effects in New South Wales; Hanslow, Morris, Foulsham, & Kinsela, 2018). This type of mapping provides higher confidence in the sea-level

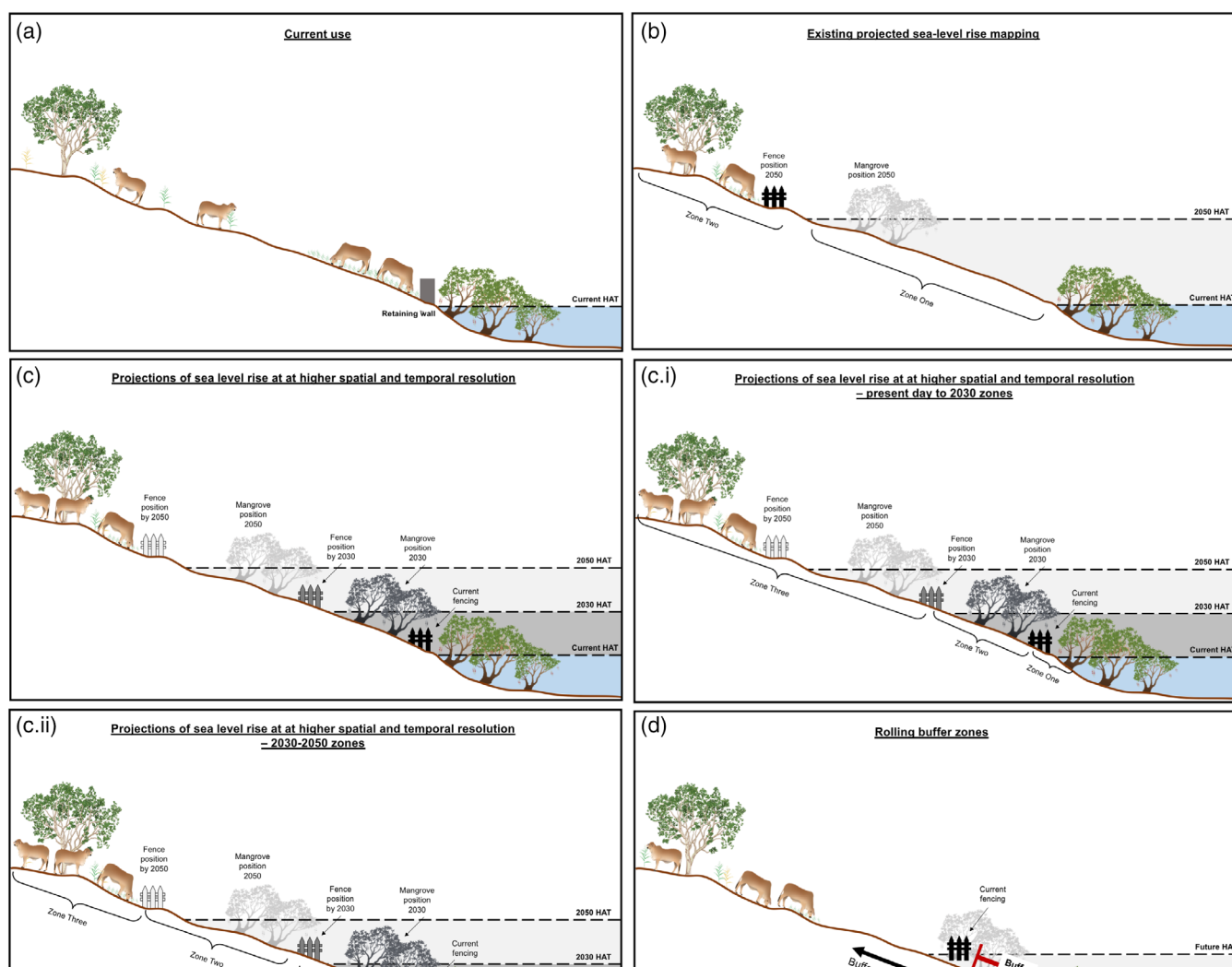


FIGURE 1 (a) Current property use may impede landward migration of coastal ecosystems. Landward migration could be facilitated by the use of rolling covenants. Implementation of rolling covenants could occur by, (b) the use of mapping of projected sea-level rise, where the time trigger for land-use change is based on future inundation mapping (e.g., likely Highest Astronomical Tide [HAT] by 2050); (c) projections of sea-level rise at higher spatial and temporal resolution, where the time trigger for land-use change is based on shorter time frames for each individual property (e.g., 2030 HAT, 2050 HAT), and each time period is stratified into a distinct range of uses (c.i and c.ii); and (d) rolling buffer zones, where the time trigger for land-use change is based on the actual rate of inundation

projections at finer spatial and temporal scales (see Figure 1c), and at this more granular level it will be possible to estimate inundation and wetland migration at shorter intervals (e.g., 2030, 2040, 2050), thereby allowing land use to change at correspondingly shorter intervals.

It could also allow for each time period to accommodate a range of uses. For example, mapping a grazing property at a finer-scale resolution could allow each temporal period (e.g., present day until 2030) to be further stratified into different intensities of use (see Figure 1c.i). In this figure, Zone One could be designated in the covenant as a buffer zone from the seaward edge of the property to accommodate natural regeneration. In Zone Two, the covenant may specify that lower than usual stocking densities (specific details to be outlined in the covenant) would be permitted while in Zone Three normal stocking densities would be permitted. These zones could then shift landward over time depending on the sea-level rise projections for that property (see, e.g., Figure 1c.ii).

The potential benefits of this approach are that it allows for a higher degree of accuracy, the use of shorter timescales, and greater stratification of land uses within a particular time period. It also allows the covenanting bodies to be more strategic in prioritizing which properties are selected for covenant projects based on the biodiversity and habitat values of each property relative to organizational goals. For example, the U.S. State of Maryland's Department of Natural Resources has prioritized land protection by incorporating sea-level rise and marsh migration projections to strategically protect only wetland areas that allow for habitat migration in response to sea-level rise (Leo et al., 2019; Maryland Department of Natural Resources, 2015). A similar approach is also currently under consideration in the U.S. State of Virginia (M.-C. Stiff, Wetlands Watch, personal communication, 2020).

However, undertaking property-level mapping including sea-level rise and inundation predictions could be both expensive and time-consuming. In addition, actual sea-level rise might not occur exactly as predicted, leading to mismatches between the land actually protected and the land which should be protected. Other possible disadvantages discussed in section 5.1.1 could also occur here too, including weed growth between coastal vegetation and the fenceline.

5.1.3 | Rolling buffer zones

While the previous two options use predetermined timescales as a trigger for changes in land use, an alternative approach is to tie the relocation of activities and structures to the actual occurrence of events (see Figure 1d).

An example of this approach is the now defunct Byron Shire Council planned retreat policy. Under this policy, development approval was only given to structures in mapped hazard zones on the understanding that the building must be relocated or demolished, or the land use must cease, if the erosion escarpment retreats to within 50 m of the structure (Byron Shire Council, 2010). Similarly, a covenant could adopt this approach, and require activity and land use to cease and move landward when the shoreline/vegetation retreats to within a specified distance, as stated within the covenant document.

The benefit of this approach is that it is more responsive to actual tidal variation as it takes into account processes like tidal attenuation and oscillations in sea level associated with climatic variation as well as rates of sea-level rise that exceed current projections. If the rate of sea-level rise is lower than expected, this would also allow the landholder to retain greater use of parts of their land for uses such as agriculture for longer. However, this approach may also create uncertainty for the landholder, and more frequent moves of infrastructure such as fencing may be difficult and costly. This approach also relies on active monitoring to identify when a trigger for relocation is activated, which can be time consuming and costly to monitor and manage in the absence of suitable remote-sensing technologies.

The success of this approach is also contingent on selecting an appropriately sized buffer zone, but the appropriate size of the buffer zone could be determined by reference to existing legislation in all Australian States and Territories that sets out buffer zones of between 20 and 250 m depending on the context (see Table 2).

Some of the instruments referred to in Table 2 set a default buffer zone for all land of a particular type (e.g., New South Wales *Land Management [Native Vegetation] Code 2018*, 20 m for a local wetland). Other instruments allow for determination of an ideal buffer area relative to the intended outcome. For example, wetland buffer guidelines in Queensland require proponents of a development to calculate an appropriate buffer distance between their development and the wetland, with the calculation including factors such as values of the wetland (e.g., important hydrological processes, habitat for distinct species) and stressors to which they are exposed. Buffer zones for gullies in north Queensland that were 5–30 m width and >1 km length were shown to be most effective at remediating erosion (Wilkinson et al., 2019), while buffer zones of 5–106 m were suggested to be appropriate for fish habitat and diversity (Bavins, Couchman, & Beumer, 2000). The design of buffer zones for coastal wetlands with sea-level rise could accommodate storm surge, likelihood of fertilizer run-off, or the need for connectivity among adjacent wetlands or other

TABLE 2 Examples of buffer zones in State and local laws and policies in Australia

State/territory	Act/policy	Distance of buffer zone
Queensland	<i>Planning Regulation 2017 (Qld)</i>	Buffer width: <i>at least</i> 50 m (urban area), 200 m (nonurban area), <i>or</i> , minimum width stated in an environmental evaluation of the wetland. [Sch 14, Requirements for high impact earthworks in a wetland protection area (s 2(1)(a))]
	<i>Accepted development vegetation clearing code: Necessary environmental clearing (2020)</i>	“Riparian protection zone” [wetland]: 100 m *The riparian protection zone includes the area between the defining banks of the watercourse, drainage feature or wetland, plus the specified distance measured from the defining bank away from the water body
	<i>Wetland Buffer Guidelines</i>	No distance specified, to be determined based on individual features of the land in question
New South Wales	<i>Land Management (Native Vegetation) Code 2018</i>	Buffer: 20 m (local wetland); 50 m (important wetland [Ramsar and some others]) (s15) • Clearing generally not permitted in these areas
	<i>Policy and guidelines for fish habitat conservation and management (2013)</i>	Buffer zone: 50–100 m adjacent to “type 1” marine vegetation and at least 50 m adjacent to “type 2” marine vegetation. (p. 55) Buffer measured from: • Highest astronomical tide level in tidal areas (generally 1.0 m AHD); or • From the top of the bank/drainage depression along class 1–3 waterways
Victoria	<i>Code of Practice for Timber Production (2014)</i>	Buffer width depends on slope degree (p. 51): • 0–30°: 20 m • 0–20°: 30 m • 21–30°: 40 m
	Some local planning schemes consider landward migration and require buffer zones: e.g., <i>Greater Geelong Planning Scheme/Strategy</i>	Does not specify buffer length but suggests “adequate to accommodate coastal recession and the landward migration of coastal wetland vegetation communities...” (p. 169)
Tasmania	<i>Tasmanian Planning Scheme [C7.0 Natural Assets Code]</i>	“Future Coastal Refugia” Areas: • Ramsar Wetlands: 100 m • Other Wetlands: 50 m (Table C7.3)
South Australia	<i>Port Adelaide Enfield Council Development Plan (2020)</i>	Erosion Buffer – set back from coast: width flexible according to factors such as the susceptibility of the coast to erosion, local coastal processes and the effect of sea-level rise over the next 50 years on coastal processes and storms (p. 32)
Western Australia	<i>State Planning Policy 2.9</i>	[Flexible approach due to varied and unique nature of water resources in Western Australia] – refers to Draft Guideline below • Identifies “existing mechanisms” as 30 m for waterways; 50 m for estuaries (p. 5719)
	<i>Draft Guideline for the Determination of Wetland Buffer Requirements 2005 [not formalized]</i>	Provided a methodology for identification of appropriate wetland buffers. • 50 m for wetlands (though may be larger) Measured from mapped wetland boundary

TABLE 2 (Continued)

State/territory	Act/policy	Distance of buffer zone
Northern Territory	<i>Land Clearing Guidelines 2019</i>	Width depends on “value” of wetland: <ul style="list-style-type: none"> • Low: 50 m • Medium: 100 m • High: 250 m Buffers are measured from the outer edge of areas that are dominated by plants adapted to seasonally saturated and/or inundated conditions (p. 51)

ecosystems. It can also ensure that there is an area of land kept free of stressors to better facilitate natural regeneration or establishment of coastal ecosystems.

5.2 | Other issues for drafting covenants

In addition to defining the covenant zones, there are a number of other important issues to consider. Defining the high water mark over time will be critical for determining the location of zone boundaries and will require consideration of factors such as whether it should be updated on an annual or (for example) 3 year average, and whether the influence of storm surge events will be incorporated.

It will be necessary to ensure covenants are appropriately drafted to include clauses prohibiting a landholder from deliberately altering or interfering with retreating vegetation, as this would defeat the purpose of the arrangement. Depending on the property features, there may also be a need to impose positive management obligations. For example, a landholder may need to actively manage weeds in the parts of the covenant area where activities such as grazing are prohibited, or actively revegetate land in areas where natural regeneration is lacking (Ross, 2006). They may also need to remove or make permeable any hard structures (e.g., bund walls) that may restrict the free movement of the tide and/or vegetation. Depending on the circumstances, there could be high value infrastructure located in this area that requires demolition or relocation, and the potential cost and feasibility of this should be considered at the outset of a project.

If a covenant is entered into under the relevant legislation, this should have the effect of “attaching it” to the land and binding any future owners of the land. However, the enforcement of obligations may be difficult (e.g., Hardy, Fitzsimons, Bekessy, & Gordon, 2017), especially if land is sold or passed on within a family (e.g., Selinske et al., 2019). If a landholder does not comply with their obligations, a covenanting entity may have to seek legal enforcement before a Court, which can be an expensive and time-

consuming process. A possible solution would be to stagger the payment of any financial incentives tied to the covenant to incentivize the completion of positive obligations.

In any of the drafting scenarios outlined above, but particularly in cases where triggers are linked to mapping of sea-level projections (Figure 1b,c), the parties will be attempting to give immediate legal form to a situation that might change significantly over the covenant lifetime. To deal with this uncertainty, a covenant may need a provision requiring that parties renegotiate the terms of the covenant at regular intervals based on agreed science or sources of science. To avoid the agreement breaking down, this could be accompanied by a clause stating that if agreement cannot be reached, then the default position remains. Alternatively, the covenant could link to a standard independent source of data in the agreement (e.g., the Intergovernmental Panel on Climate Change's projected sea-level rise/government sea-level rise projections), and as this is amended, the content of the covenant necessarily changes as well.

6 | NEXT STEPS AND CONCLUSIONS

Our assessment of legislation and the information derived from semistructured interviews suggests that covenants to accommodate the landward migration of coastal ecosystems with sea-level rise on private land are feasible. Additionally, there are a number of suitable options for drafting covenants that could be linked to national or subnational standard sea-level rise projections, or directly to changes in the natural landscape. However, we acknowledge that the rolling covenant arrangements may not be politically palatable to all government agencies and feasible in all locations. It has been suggested that these mechanisms may be considered practical in low-density coastal settlements (Fletcher et al., 2013), and we consider the rolling covenant approach particularly suitable to rural farming areas where land parcels are larger and coastal fringe

ecosystems are likely to have a better chance of landward migration. We further suggest that rolling covenant arrangements will be most suitable in situations where a funding source is available to incentivize property owners to enter into a covenant and/or to undertake the works required (e.g., fence movement, weed control) to maintain the conditions and/or offset opportunity cost through loss of some grazing opportunities. For example, conversion of agricultural land to wetlands increases carbon storage in the landscape (Burden, Garbutt, & Evans, 2019; Limpert, Carnell, & Macreadie, 2021), which may have value to landholders if wetland greenhouse gas abatement credits can be sold in carbon markets (Kelleway et al., 2020).

This article outlines the potential legal and policy opportunities for utilizing rolling covenants in Australia. Designing programs for rolling covenants should be informed by lessons learned from what has/has not worked for the uptake of covenants and other similar programs in coastal and other environments (e.g., Edwards & Traill, 2002; McCristal, 2015). While research on conservation covenants in Australia is increasing, including around the motivations, barriers and on-ground outcomes (Archibald et al., 2020; Selinske et al., 2019; Smith et al., 2016; Stephens, Lambert, Elix, Morrison, & Kennedy, 2002), there is still much work to do (Fitzsimons & Cooke, 2021; Fitzsimons & McDonald, 2021). Therefore, designing monitoring and research programs for spatially dynamic rolling covenants will be important.

Appropriately drafted covenants may be a low cost solution to coastal squeeze, allowing landholders to beneficially use land in the short to medium term, which may be preferable to an outright acquisition of land or engineered solutions to maintain coastal wetlands (e.g., Sadat-Noori et al., 2021). The use of rolling covenants to prevent coastal squeeze provides opportunities for coastal wetlands to be maintained and even enhanced in cover, thereby delivering important ecosystem services for the coast into the future.

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CONFLICT OF INTEREST


The authors declare no potential conflict of interest.

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