Obsolescence Arising from the Transformation of Property Rights Due to the Effect of Sea Level Rise: A Property Economics Perspective

Garrick Small*

Central Queensland University

Sea level rise has the potential to compromise private property rights for a spectrum of coastal property types globally. This paper surveys the range and magnitude of impacts in order to move to the analysis of a case study of Australian urban waterfront property with a focus on Coogee in Sydney. The analysis reveals that while sea level rise has the potential to erode valuable private property rights, the magnitude and time frame is such that it can be compared to other changes in the value of property and capital assets for which depreciation is not considered controversial. That is, the risk of sea level rise may be conceptualised as transforming affected properties into something that performs in a manner other than that usually associated with city waterfront land. The legal and political issues are calibrated by reference to the property economics of possible physical outcomes over the next century. It is argued that the transformation of a property asset that is normally associated with strong and continuous capital gain into one displaying physical obsolescence represents a real transformation in the nature of the property right. This raises issues surrounding the social significance of land subject to capital growth which may be due for critical review.

Keywords: *sea level rise; residential property markets; just terms compensation, environmental infrastructure funding, environmental economics, urban economics, Georgist environmental land tax.*

Australian Department of Climate Change (2009) is representative of popular concern currently held regarding the impacts on private property of sea level changes due to climate change. The prospects of sea level rise eroding valuable coastal land immediately connotes dramatic changes in the human utilisation of what is commonly the most valuable and productive land property. The scale of the problem and the time frame over which it occurs, have implications for the impacts on property rights and appropriate policy responses.

*School of Commerce and Law, Central Queensland University, Bruce Highway, Rockhampton, Queensland, Australia/ Email: g.small@cqu.edu.au

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Various land uses and social contexts will also impact on the significance of sea level rise for property rights. At one extreme are the subsistence needs of farmers in low lying areas of developing nations where sea level rise threatens to extinguish their material livelihood. At the other is waterfront residential land in the cities of advanced countries where the impact will be almost entirely in terms of financial cost. Between these extremes there are many situations that combine aspects of both.

The implications for these two extreme cases should not be confused. This paper will be focused on the property rights aspects of sea level rise primarily in terms of financial impacts where water front property is held for reasons other than direct subsistence and use these to review appropriate strategies for responding to the problem.

THE SCALE OF THE PHYSICAL PROBLEM

It is believed that the sea level stabilised following a 120m rise following the last ice age and with the exception of the last century has been stable for the last two or three millennia (IPCC 2007). The last century is believed to have experienced sea level rise of between 10cm to 30cm though there is considerable variation in the studies (R. Warrick 1990). In 2001 the IPCC estimated sea level rise through the twentieth century of 1-2mm/year but has more recently adopted 1.7mm per annum over the last century. It anticipates that this will accelerate to about 4mm per annum by the end of the current century.

Most forecasts look to the year 2100 with the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) recognising the range of available credible forecasting models that suggest sea level rises of between 20 and 80 centimetres above that of 1990 (CSIRO 2012). The CSIRO estimate was taken from the Intergovernmental Panel on Climate Change Forth Assessment Report (Solomon, Qin et al. 2007) and suggests a likely increase of about 50cm. It also notes that some higher estimates exist that rely on "scaling up factors" for which "there is no firm theoretical or observational basis" (Solomon, Qin et al. 2007). Including these scaling up factors leads to forecasts that suggest possible a sea level at 2100 of 80cm above the 1990 figure. Without scaling up factors no comprehensive model returns sea level rises of more than 60cm on 1990 levels (Church, Gregory et al. 2011).

The Australian government has adopted an estimate of 1.1 metres of sea level rise by 2100, apparently on the basis of opting for extreme caution, despite none of the reputable models adopted by the CSIRO and IPCC providing any scientific support for rises of this magnitude (CSIRO 2012). Some authors, such as Corkill (2012), are of the opinion that policy should be based on sea level rises substantially in excess of 1.1 metres. Australian Department of Climate Change considers that

"Very recent research also suggests that a 1.1 metre scenario by the end of the century may not reflect the upper end of potential risk, and that risk assessments could be informed by a higher level" (Australian Department of Climate Change 2009, 27). This higher rate of sea level rise is determined on the basis of "An alternative approach (which) is to base projections on the observed relationship between global average temperature rise and sea-level rise over the past 120 years, assuming that this observed relationship will continue into the future." (Richardson, Steffen et al. 2009, 10) This approach yields considerably higher results, though it is based on a simple and unproven statistical correlation that is not causally linked to the phenomena in the same way as the more conventional forecasting models recognised by the CSIRO. Despite the alternative approach having been published in 2009, the CSIRO has not yet seen fit to adopt this simplified methodology, expressing concerns that "there is little available information to quantitatively test their predictive skill over decadal periods" (CSIRO, 2012).

This paper will adopt the CSIRO/IPCC forecast of 20-60cm and assume a sea level rise in the vicinity of 50cm by 2100 is a reasonable expectation based on the best scientific estimates currently available. While it is important to be realistic in addressing this problem, it is important to avoid excessive forecasts in either direction.

A rise of half a meter in sea level will have differing effects depending upon the grade of the land at the coast line. It will also realise the effect over the period of a century, that is, at the rate of about 5 millimetres per year vertically. In the vertical direction this will be imperceptible annual change. However, in the case of low lying coastal land presenting an average grade of say 1%, it will result in an annual movement of about half a metre in the horizontal alignment of the mean high water mark (MHWM).

In addition to sea level rise, there is a common opinion that storm events may become more frequent in the future, leading to acute erosion events. At present there is no clear evidence of this being a proven scientific fact, despite the common expectation regarding the future. The impact of storm events on coastal erosion is not a new phenomenon and has been an historical fact of coastal landforms. This suggests that identifying the additional impact of increased storm frequency and intensity will take some time. In particular, the temptation to label any storm event as related to climate change must be avoided if scientific method is to be respected.

Habitable buildings must have floor levels that are not only above mean sea level, but above the maximum sea level height reasonably anticipated. This means that in addition to the cadastral norm of land boundaries following at least MHWM, allowance must be made for extremes in tides (king tides) and also for the additional height of storm surge superimposed on a king tide. Increases in sea level will push this permissible building level higher by the sum of the sea level rise plus the storm surge allowance. At present estimates of sea level rises appear to be settling to scientifically defensible limits, however the magnitude of storm surge due to climate

change is entirely speculative opinion which may require some considerable time to be able to estimate with any reliability.

In addition to the direct impact of sea level rise on floor levels, there is also the threat of erosion effects. This will be highly dependent on the nature of the coast line with sand beaches being most vulnerable while rock faces may be only minimally affected.

The impacts on property rights and the practical importance for policy will be moderated by the particular circumstances of this gradual change. This paper will consider several scenarios and the appropriate policy and valuation response.

ACCRETION AND EROSION IN LAW

The common law principle of accretion and erosion dictates that where physical waterfront boundaries change over time due to the slow and imperceptible actions of nature, the legal boundaries follow also. This general principle is moderated by particular statutory regimes, so that in Queensland (Qld) it applies to all water boundaries, but in New South Wales (NSW) non-tidal lakes are excepted. Likewise s.55N Coastal Protection Act (NSW) 1979 limits claims for accretion further with the conditions that the perceived trends must be anticipated to continue indefinitely and any declaration of accreted private boundaries will not inhibit public access to beaches, headlands or waterways.

The movement of boundaries due to changes in watercourses or water levels has a rich history because it can markedly affect property rights. In the case of rivers, it is well known that the outer edge of bends tends to erode over time, whereas the inner edge tends to accrete, that is, the land tends to grow towards the centre line of the stream. This means that farmers on either side of a river tend to exchange property rights over the course of time, which is not at all in the interests of the side suffering erosion. Moreover, there is no legal remedy against the loss of land due to erosion, so long as the land is lost slowly and imperceptibly. The loss is not considered a loss to the state, even though the body of the watercourse may be reserved to the state. Hence, compensation for the land implicitly resumed is not applicable. Land gains due to accretion are not usually controversial as private owners are seldom offended by increases to their holdings.

In the case of tidal waters, the boundary defined by the MHWM may change due to changes in sea level. These are more precisely referred to as diluvium and dereliction however, it follows the same basic principles as accretion and erosion respectively (Corkill, 2012). In particular, slow and imperceptible changes resulting in dereliction, or loss of land, due to sea level rise is a non-compensatory loss of property.

Movement in sea level in the order of millimetres per year will be slow and imperceptible, even though it is anticipated. This is comparable to holding property on

the outer bank of a river. For this reason under current practice, at least in common law countries, the impact on private property rights is uncontroversial, despite its discomforting prospects for landowners.

IMPACTS FOR URBAN PROPERTY

Slow and imperceptible change is amenable to adaptive responses, however much of the popular attention is focused on the end point impacts. The Australian Government's Department of Climate Change's (2009) study on the impacts of climate change on coastal property suggested that over 247,600 homes could be at risk representing a cost of up to $63 billion. These estimates are based on the replacement value of affected buildings and appear to be still only very approximate estimates. The Department's 2009 report represents a 60% drop in own estimates compared to its own 2008 submission to a government enquiry (Australian Dept. of Climate Change 2008). The rendering of the 2008 submission for the public suggested eventual costs up to $150 billion (Doherty 2008). Clearly the science regarding the impact on property is far from settled at this point in time. The Department's 2009 estimates will be adopted for this analysis.

An aspect of cost that the Department's estimates do not currently consider is the impact on land values that would be likely to attend any loss in amenity due to sea level rise. A property that develops an exposure to extreme sea related hazards is not likely to hold its land value. Coastal residential land values are amongst the highest residential values in Australia. For example, the coastal Sydney suburb of Coogee represents one of the more modest coastal suburbs in that city, yet its current median property price is hovering about $1.5 million (RPData 2013) compared to Sydney's average house price of about $605,000 (ABS, 2013a,b). This might suggest that if the sea hazard affected properties in Coogee were to fall by 50% due to the hazard blight, they would still be above the city's average, but the landowners would suffer costs in the vicinity of a million dollars once the land value blight was combined with the direct building cost loss. This is an area for further research and modelling. It suggests that alternative responses would be more prudent.

In terms of social and financial impacts on property it is important to recognise that the effect will take about a century to realise. That is about four social generations and perhaps up to eight or twelve generations of landowners. This means that the cost of adjustment may be distributed over a considerable time and a significant number of persons. This alone moderates that real significance of bald estimates of cost.

At a rate of a few millimetres per year of vertical rise and even allowing for that impact to be multiplied by the effect of grade for gently sloping coastal frontages, the impact will still be within the scope of 'small and imperceptible' required for the doctrine of accretion and erosion. If the Department's 2009 estimates are adopted,

the annual cost per household will be in the order of $2,500 for direct building costs, or about the cost of local government rates. This figure ignores impacts on underlying land values that could push these costs in some cases as high as $10,000 per property per year, or about 0.67% of the property value per year.

While this still represents a burden, regardless of how it is conceptualised, the likely annual property cost is somewhat less problematic than the threat of a national cost of $63 billion. These estimates are also based on the prospects of no active response of preventative measures. It could be considered as a worst case scenario as there will be considerably more cost effective strategies for dealing with the problem. The IPCC (2007) report recognised this when it stated: "Adaptation costs for climate change are virtually certain to be much lower than damage costs without adaptation for most developed coasts, even considering only property losses and human deaths" (Parry, Canziani et al. 2007, 40).

To put this into perspective, the last century has seen considerable activity directed at winning land back from the sea. Beach Road in Singapore no longer has ocean views due to the extensive reclamation activities that have greatly expanded the land about that city's CBD, as well as other reclamation projects around the island. Sydney Harbour contains many valuable locations that did not exist a century ago. The people of Holland have had to deal with massive threats to their land mass for over a millennium and for centuries have been successfully preventing the incursion of the sea. This level of experience in turning back the sea should be seen as evidence that there is ample capacity within the global human community to deal with.

The most obvious strategy in the case of threats to coastal urban lands is the construction of sea walls to protect vulnerable properties or locations from the extreme events that may threaten them say in 2100. Continuing with the Australian case study, if a 1.5 metre high granite sea wall is considered with an average allowance of 50 linear metres for each affected property, the total cost would be less than $2.5 billion distributed over a century, or about $100 per property per year. Given the congregation and distribution of coastal residences, the estimate of 50m per property would appear to be extremely generous, but the resulting cost remains insignificant compared to property values. It is also insignificant compared to the prospects of direct property costs.

A protective wall of this height could perhaps be effective for perhaps over two centuries if the CSIRO estimate of most probable sea level rise is realised over the coming century or so. Current forecasts of sea level rise assume the melting of a considerable proportion of land-based permanent ice. The question of an eventual deceleration in sea level rise once most land-based ice has melted does not appear to be currently included in consideration, but it is not unlikely that a new stable level will result once this happens. This would suggest that preventative measures may need to be augmented eventually, but that need is likely to abate over a period of a couple of centuries.

Overall, it is important to maintain perspective. Dealing with the possible problem at 2100 is well within the scope of reasonable possibility and has a considerable lead time.

FUNDING ISSUES

The prospect of building sea wall protection is not novel, and has been done for a variety of purposes in the past. It would be a community project as the likely location will be determined on the basis of what serves the affected community best. It will become a form of public physical infrastructure, and as such it is likely to be funded though the community. The impact of the measures will be geographically defined and represent a valuable contribution to the maintenance of affected private property values.

The estimates derived above suggest that control measures costing in the vicinity of $100 per property per year would protect landowners from property costs somewhere between 20 and 100 times that amount. There will be a clear nexus between the benefit to private landowners and the control measures. For these reasons the most appropriate mode of funding would appear to be a premium charge or levy applied to local government ad valorum rates. The advantage of this form of infrastructure funding is that it provides a close connection between those paying for infrastructure and those benefiting. Given that these control measures may need to be eventually augmented, if they become adopted by the affected community, once the initial measures have been paid for, a continued levy could provide a growing fund for future additional works.

The impact of such a levy would be insignificant on the affected properties. Notionally ad valorem rates reduce net property rental income, which should impact on capital values though the mechanism of capitalisation. Capitalising $100 at a very lean 3% only results in an impact on rational property values of 0.2% on property values in localities such as Coogee, which is negligible.

The question of affordability of these measures was partially addressed by Tim Lohman (2013) in his review of the impacts of Hurricane Sandy on waterfront property in the US. He noted that with respect to insurance costs or other costly adaptations to disaster management "If you are talking about exclusive areas near the waterfront, I don't think it matters so much to the people buying there" suggesting that property values would not likely fall as a result of disaster damage risk increasing (Lohman, 2013, 21).

By contrast, if these measures were funded from general taxation revenue, the burden would be carried by persons who were not directly affected by the measures at all. Adopting the figure of about a quarter million households affected by sea level rise suggests an affected population of about 640,000 using average Australian household occupancy (ABS, 2013b). This is merely 3% of the Australian popula-

tion, and generally the 3% able to afford property at least three times the average. That is, a benefit that would eventually accrue to affected households of between $250,000 and $1 million per household would be provided from taxing the remaining 97% of the population who would derive no direct benefit from the expenditure. When it is further recognised that water front property is usually the premium end of most residential markets, the taxation of the general community to protect the interests of those most able to afford to take measures to protect themselves becomes even less attractive.

OTHER IMPACTS

Damage to private property will be only part of the cost of sea level rise. Sea level rise combined with the prospects of increased storm activity pose an additional threat to beach systems. Beaches form a key part of the attraction of coastal living, especially within coastal cities, such as Sydney. Their loss through erosion constitutes a social cost to the community considerably beyond the personal costs to private property. Erection of retaining walls to prevent storm damage to low lying properties may actually accelerate the decay of beaches, making the protection of private property into a major public cost.

It is only in the last half century that the dynamics of beaches have been sufficiently understood to enable responsible management (FitzGerald, 1988). Prior to that considerable development was permitted on the dune systems behind beaches that are now known to be vital for beach sustainability. This means that existing private property rights apparently remote from beaches are responsible for beach failure and erosion. The appropriate response to this problem would be to recognise the irresponsibility of these private property rights and to amortise them over time with a view to returning entire beach systems to the public domain.

The threat of sea level rise is especially pertinent to these near-waterfront properties and their abandonment by private owners would yield significant environmental benefits. The problem exists that they represent some of the most valuable property in their respective cities and their owners have strong attachment to their superior positions. This makes the prospects of resumption in the normal manner impractical.

PROPERTY RIGHTS PERSPECTIVE

It is not prudent for the state to make available land for uses where the circumstances of that land make the land use hazardous, or where the land use will create negative externalities for others. This principle is standing behind the practice of preventing new urban land uses in locations known to be flood prone, or in

planning regulations aimed at minimising negative externalities from adjacent uses. Property rights are therefore implicitly premised on the assumption that valuable private use of the land is possible without undue risk to the occupant or others. Private property rights that exist in cases where the intended land uses are either not possible, or result in excessive negative externalities, can be said to be dysfunctional.

In the former case, land values usually follow the prospects of practical utilisation. Hence, if high density commercial use is permitted on a site, but the surrounding community is not such to be able to support it, the land value will reflect whatever lesser use is practically likely. Applied to the present case, this suggests that by 2100, even though the affected properties are zoned residential (or whatever) their physical suitability for this land use will have slowly and imperceptibly disappeared and their values will reflect this lower practical reality.

The doctrine of accretion and erosion can be conceptualised as recognising the slow and imperceptible change in certain boundaries of practical intended land use. That is, in the case of erosion to a river frontage, the submerged land no longer fulfils the purpose for which it was granted and the private property right dissolves. There is no fundamental reason why the original boundary cannot perdure, or why river beds cannot be a part of the earth's surface recognised as a private property right. The positive reason for this convention, and the common law that is drawn from it is that private land is a bounded parcel of the earth's surface intended for certain uses that are only possible on dry land.

Interpreted in this way, waterfront and near-waterfront land is threatened in its very rationality as a private property right by the prospect of sea level rise and other possible consequences of climate change. That is, as a result of climate change it will slowly and imperceptibly become a dysfunctional property right.

This emerging dysfunction extends beyond that land simply submerged below the MHWM to the limit of that affected by the hazards of extreme tides and storm events. This would suggest that the erosion doctrine would appear to be equally applicable to the erosion of practical land use in that hinterland vulnerable to extreme tides and storms. The planning implication of this reality is that controls preventing development on low lying land that can be shown to be subject to tide and storm hazard should be strengthened and made subject to review based on physical changes in the boundaries of land so blighted. This would be analogous to boundary changes due to erosion or dereliction.

A separate category of dysfunctional property rights has already been noted being those over land that forms part of beach dune systems that were granted before an adequate scientific knowledge of the externalities these entail for beaches was available. These coastal property rights represent a huge cost to the community, either in terms of loss of beach amenity, or the cost of rehabilitation that is usually borne by the entire community. That is, of its very nature the private property right results in an ongoing public cost.

AMORTISING DYSFUNCTIONAL PROPERTY RIGHTS

Apart from civil engineering responses to the problem such as walls and reclamation projects, it still may be necessary for some property rights to be extinguished as the most appropriate response to sea level rise. This could be achieved using strategies that are both theoretically robust and already found applied in various other circumstances. A property rights perspective provides a key to understanding the logic of these strategies.

Unlike most non-land property rights that tend of depreciate over time, land based property rights are commonly perceived to appreciate over time due to their participation in the overall community well being. This was first recognised by Adam Smith (1778 reprint 1910, 228) and is now a commonplace. It only holds in situations where communities are growing in either physical or economic terms as is illustrated in the negative by ghost towns.

Ghost towns are comprised of properties whose practical land uses have collapsed. While this is proximately associated with the population flight, it is usually ultimately the result of some physical change that makes it impossible to support that population. This is most evident in the case of mining towns where the mines have been exhausted.

Coastal land affected by sea level rise shares some similarities with emerging ghost towns. Both involve land that may lose its practical ability to support its previous land use due to external 'environmental' changes including exhaustion of resources and population movements. Both are associated with the prospect of falling land values. Also, adopting the institutional norms of property law, for different reasons they both do not warrant compensation; ghost towns because of lack of demand and coastal properties due to dereliction. Finally, both are reasonably predictable, in that mines are not inexhaustible and current science is claiming reasonable capacity to forecast circumstances a century hence.

This parallel suggests that rather than become too anxious about the quantum of potential future cost as the Department of Climate Change appears to be, the more prudent approach is to educate the community to the likelihood that these properties should be considered as a depreciating asset. If is known that a line can be drawn around those properties that in a century's time will likely be uninhabitable, then the market should price the property asset as a terminating interest. This pricing is within the competence of the valuation profession and resembles depreciation. It can be deduced from the common definition of property value as being *the present value of all future rents*. In the case of a terminating interest they should be computed as the present value of the rents remaining. These would be limited to the number of years between today and the year 2100 when the present sea level forecasts mature. Quantitatively this equates to a depreciation of about 1.1%pa on a straight line basis.

This level of depreciation is hardly extreme and is somewhat below the rates of depreciation applicable to some types of property and well below that applicable to

most manufactured assets. Conceptually it means the conversion of these property rights from behaving similarly to financial assets, such as equities that tend to appreciate, into something comparable to physical assets, such as buildings or machinery, that do depreciate.

This type of rational response is not always found in the property market as can be seen from the behaviour of long leases. Small (2008) found that the pricing of long leases demonstrated irrational expectations near the end of their terms, generally resulting in overpricing of the lessee's interest which can have political ramifications. In the case of sea level rise many decades off, especially given current uncertainty as to the eventual magnitude of the problem, there will be the tendency for many to downplay the eventuality, leading to overpricing until the hazard is rendered real and present. This would suggest that measures additional to the market should be considered.

Several strategies exist for amortising property rights over time. For example this has already been done in many instances through the instigation of planning regulations that enact restrictions to effectively place a horizon on the land use and thus initiate a period of implicit depreciation. These have negligible present effect, but ensure long term goals are realised. For example, 'existing use' provisions on planning instruments have no impact on present continuing land use, and hence value, but do limit the future prospects for the land, usually to a less valuable land use.

Likewise, augmented building requirements, such as those introduced with the introduction of the Building Code of Australia, mean that existing building methods can be replaced with more appropriate ones that in this case could include provisions directed towards minimum floor levels with respect to MHWM. Economic building life is significantly less than one hundred years for residential building which suggests that it is unlikely that many residences existing today will be standing at 2100. Those that are replaced may be 'sea level' proofed as they are replaced in the normal course of the replacement of building stock.

This augmentation will be in the interests of owners and given Lohman's experience in the USA with waterfront owners, they will belong to a part of the community most able to accommodate them. To the extent that many properties identified as being within the range of impact from sea level rise by 2100 by Australian Department of Climate Change (2009) will be vulnerable only in the case of extreme storm surge and then only to the extent of water inundation, insisting on these measures will be a very low impact change.

A more aggressive form of amortisation of these problematic property rights would be to set explicit future use provisions in planning provisions linked spatially to vulnerable areas that would set an explicit date on the dissolution of current land use allowances. This would put a more concrete future date on the change of permissible uses and send a strong message to the community that regardless of uncertainty over the realisation of current forecasts, the land would lose most of its value at that point in time.

CONCLUSION

The current concerns over sea level change will crystalise into a reality over the better part of a century, perhaps within the current anticipated range, or perhaps beyond it. Either way it will take considerable time during which the change will be slow and imperceptible to the casual observer. This means that focusing too much on the total impact at the end point is not especially useful. In the case of urban waterfront property it is unlikely that the land will be simply permitted to be lost to the sea or rendered uninhabitable due to storm surge risks. Instead proactive responses, such as the construction of protective sea walls has been shown to be a considerably more cost effective approach and one that has been successfully utilised in places such as Holland for centuries.

Funding preventative measures will not be onerous, so long as it is provided for over the longer term and will be a minor contributor to housing costs compared to, say, local government rates. It has been argued that funding via an ad valorum levy on affected properties is the most appropriate mechanism as it links the beneficiaries, who stand to gain by a factor of perhaps one hundred times the cost of prevention.

Even if no preventative measures are taken, the depreciation of affected properties that will be uninhabitable by 2100 will only represent an annual value loss in the vicinity of 1.1%pa, which is considerably less than that suffered by most depreciating assets. The principle of accretion and erosion would appear to apply since the rate of annual vertical movement will be only in the range of a few millimetres per year and the horizontal movement will still be comparable to that admissible in cases of river erosion.

Several strategies exist for facilitating the rational pricing of affected properties to ensure that the property rights are progressively amortized by the market. These could include various planning measures aimed at terminating coastal living in threatened areas and strengthening of the building code in these areas to make them resistant to the likely hazards.

In some cases, such as existing property within fragile beach dune systems, amortising the private property rights will be a prudent measure regardless of the threat to these properties as releasing the dune systems under them may be vital to the sustainability of the beaches themselves. However even in these cases early action aimed at gently dissolving the property rights over a length of time will be more desirable than the violence and public expense of resumption.

Overall, a property rights perspective is helpful in conceptualising the problem. The creation, transfer and dissolution of property rights is a useful paradigm for making the problem manageable and clarifying the dynamics of appropriate responses.

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