Editorial

The Effects of Sea Level Rise and Increased Storm Events: An Editorial Introduction

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Global communities are more aware of the increased frequency, duration and severity of storm events and their impact on coastal land, development and populations. Whether such storm events are also coupled with climate-driven sea level rise has been the subject of division notably within polities of the developed world. Conversely, in November1993 the (then) Resource Assessment Commission stated in its prescient *Coastal Zone Inquiry Final Report* to the Australian Prime Minister:

> *…(f)rom a resource management perspective, the uncertainties related to the climatic and sea-level implications of an enhanced greenhouse effect are closely linked to the natural dynamics and variability of physical processes that operate in the coastal zone. Regardless of possible sea-level rise and accompanying changes in wind and wave strength and direction due to the greenhouse effect, variability in the frequency and severity of storm events presents a significant hazard along many parts of the Australian coast.* (Resource Assessment Commission, 1993, 13)

Approximately 15 years later, Hiatt (2008, 395) optimistically observed U.S. coastal land holdings will over time adjust to "the climate changed future." However today, coastal real estate globally continues to be vigorously marketed due to scarcity and proximity to attractive coastal assets such as beaches, waterways and estuaries. Hence, in many parts of the developed world there is a somewhat bizarre mindset that places the loss of the coastal property at a future date so remote it can be ignored. The notion of change and causality is dismissed.

Arguably, threatened coastal properties should reduce in value as the prospect of inundation by sea level rise or damage from increased storm events becomes "more accurate and localised" (Hiatt, 2008, 395). The stark reality of coastal property markets is such that the almost irresistible attraction of coastal living continues to outweigh the growing prospect of forfeiture of such property due to sea level rise and increased storm events. As a result, mitigation measures in wealthy developed na-

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tions (as culturally diverse as New Zealand, Israel, Australia and the United States) are being increasingly implemented to protect private property rights situated on the coast of those countries. For example, in November 2013 the New Zealand city of Christchurch released a rather pragmatic study on the effects of sea level rise emphasising the need for protection responses for private property stating:

> *...[w]here development exists in areas at risk from coastal erosion where no protection exists, there is likely to be pressure on local authorities to protect private properties from coastal hazards over time.* (Tonkin & Taylor, 2013, 67)

However, it is clear much of the world's population is located in less affluent coastal regions (such as west Africa), and as sea level rises and increased frequency of storm events become more apparent, arguments as to whether such phenomena are natural or anthropogenic become irrelevant. The large scale dispossession of coastal populations will occur once certain "biophysical thresholds, such as mean sea levels" (O'Donnell and Gates, 2013, 234) are persistently broached. Dispossession of these populations represents a major humanitarian relocation task for international agencies, and cultural, financial, environmental and food security costs will be significant.

Hence, the management of coastal lands, coastal estuaries and rivers is now a source of considerable interest to geographers and planners. The manner in which we assess the prospective impact of climate change, sea level rise and increased storm events is crucial to how adaptation or even mitigation can and ought to occur. The tools for such mitigation or adaptation are of necessity both complex and cross-disciplinary. An algorithm is yet to be conceived for realistically predicting the probabilities of sea level rise and increased storm events in specific locations and times.

Unsurprisingly, the intersection of climate change mitigation and adaption with property law highlights the policy conundrum faced in many countries, notably developed and emerging economies. Freyfogle (2003, 7) forcefully argues this situation has arisen because events in nature are generated by causal processes acting over time, and:

> [n]ature is an interconnected whole, one parcel fully linked with the next. Even a seemingly slight action on one tract of land can trigger far-spreading ecological ripples. Much of today's conflict about property rights has arisen precisely because land is so different in law an in nature.

Aside from statutory land use planning and other environmental controls, the recognition that much coastal land is held as private property rights is a sobering thought for policy makers. The protection of coastlines, and coastal and estuarine communities, creates an interaction with often valuable private property rights which has to be addressed, managed and resolved. This interaction appears primarily the responsibility of local government which usually has "a limit to its powers" (Mamouney, 2000, 145), often poorly resourced financially, coupled with a scarcity of crucial coastal expertise.

Further, much of the private tenure in some climate-impacted areas is either traditional or customary (Mitchell, 2010). Ancient land tenures held by Indigenous

peoples could suffer a second wave of colonial dispossession, given climate change has been generally sheeted back to the developed world due to the increased emission of greenhouse gases since the commencement of the industrial revolution. Civil engineering options in such areas may hasten this Indigenous dispossession through the deflection of storm-driven erosion if "incorrectly or sited inappropriately" (O'Donnell and Gates, 2013, 224). In addition, alternative climate change adaption strategies described as soft engineering, such as coastal sand enrichment and sea grass planting, can certainly protect local areas from erosion. However, such alternative strategies may also restrict the access of coastal populations to marine resources such as fisheries, resulting in the reduction or eventual commutation of valuable nutrition sources for coastal Indigenes. Other market-driven techniques such as transferable development rights (Renard, 2008; Sheehan, 2011) have only limited applicability, and are most likely inappropriate when dealing with threatened inalienable Indigenous property rights.

This special issue of *Geography Research Forum* therefore aims to canvass the impact of sea level rise from a number of standpoints including planning, law, political economy, property rights and climate change policy. It is clearly not possible to accurately establish the impact of projected sea level rise and increased storm events, but the inevitable impact associated with these phenomena is evidenced by a growing awareness in academia, planning practice and the legislatures.

The first paper by Andrew Kelly takes us on a historical journey through the development of local government planning for the Australian coastline, with a focus on the State of New South Wales (NSW). Kelly skilfully leads us through the prolonged development of land use planning which historically ignored the coast; whilst now "more sophisticated" Australian planning still relies on exclusory zoning, the genealogy of which lies in the British *Town and Country Planning Act, 1932.* Until the late 1970s, local government planners eschewed "the speciality of coastal lands", but Kelly explains how in 1976 the (then) Planning and Environment Commission required local government to re-zone "non-urban lands" to include designations (amongst others) referring "particularly to the coastline, associated dune formation and headland." Subsequent to this Commission directive, he finds local government increasingly receptive to the development intentions of private coastal land holders, supporting their proposals often contrary to the Commission's wishes. Any zoning protection of vulnerable NSW coastlines only occurred if the lands were held or managed by local government, private land being often excluded from environmental conservation measures by timorous elected local government officials. In a sobering analysis of the current response to issues such as sea level rise and increased storm events, Kelly concludes local government remains poorly resourced to respond to such issues though the statutory land use planning regime notwithstanding "local government now lies at the forefront".

The second is a more property rights specific paper provided by Mick Strack, motivated by the complexity of New Zealand tenures at the terrestrial-marine in-

terface at a time when sea-level rise is creating unanticipated tension for survey law and practice, and land use planning. The cultural plurality of this antipodean society is revealed in Strack's careful explanation of a dichotomous tenure system embracing both Maori and settler boundary approaches. Tension is also evident in the duality of broad public expectations of access to coastal land, which land can be privately held diminishing public perceptions of freedom to access the coast. The 2010 Coastal Policy Statement (NZCPS) should have shifted the balance towards more "effective controls on coastal development" but is viewed by Strack as "somewhat ambiguous" in protecting the coastal environment and enhancing public access. Coastal land whilst threatened by sea-level rise and erosion due to storm events is still in strong demand for development, resulting in increased demand for local government to protect these private assets. The "impermanence of coastal land and the ambulatory nature of boundaries" due to climate change should be a clarion call for effective coastal management in New Zealand, and yet the continued forceful assertion of private property rights is impeding the necessary planning response.

Following these two papers dealing with local government responses to sea-level rise and storm events, the third rather quantitative paper by Michal Lichter and Daniel Felsenstein searches through flood scenarios along the Israeli coastline to ascertain whether property vulnerability and the social composition of vulnerable communities coalesce. This fascinating research delves deeply into the "subtle distinctions between property and population exposure along the Mediterranean coast of Israel, and aims to show that protecting socially vulnerable communities "is not just an issue of coastal management and planning but also of social equity and justice." Using inundation modelling for increments of 1, 2, 5 and 10 metres elevation, Lichter and Felsenstein delineate possible flood zones based on coastal local government areas (municipalities). Property exposure is based on floor space and monetary value, whilst social exposure uses the population exposed to inundation risk and their relative socio-economic status. For exposed residential properties, they demonstrate "it is actually the small communities that rank highest" across all inundation scenarios, and bear a greater financial cost. The modelling also reveals those smaller communities also house more socially vulnerable residents and have "less coping ability in the face of an external shock" such as sea-level rise or storm events inducing flooding. Lichter and Felsenstein urge caution when planning to rebuild or restructure vulnerable small communities after such shocks given the history of failed programmes based on "public sector opportunism."

Following this quantitative work, is a fourth paper which offers a very different perspective on sea-level rise being motivated by the shoreline dynamics of the Laurentian Great Lakes situated between the US and Canada. While the previous papers looked at vulnerable boundaries with the open seas, Richard Norton Lorelle Meadows and Guy Meadows deftly analyse the response by the eight US States to climate change in managing their shore lands of the Great Lakes. They point out this vast bounded water body is not tidal like ocean seas, but the water levels

"oscillate naturally on seasonal, decadal, and multi-decadal time frames" subject to the hydrologic cycle rather than the moon's gravity. However, in a familiar theme they also describe how the States of Indiana and Illinois (in particular) struggle to effect development controls based on the "elevation ordinary high water mark" (EOHWM) as holders of shoreline private property rights forcefully pursue development "lake ward on their temporarily inflated beaches." Management of the Great Lakes shorelines has always been dynamic historically, but the various States' unique "constitutional and common law doctrines and corresponding legislative" regimes are now being tested by the impact of climate change on those dynamics. Shoreline movement landward due to rising water levels is now increased by greater "storm frequency and severity" and presumably more frequent high winds which can increase destructive waves. Inundation and later re-exposure of old shorelines are patterns which are familiar in the Great Lakes, however Norton Meadows and Meadows soberly reveal global climate change could "exacerbate the effects of fluctuating water levels at the shore" due to increased frequency and severity of storm events. Public access to shore lands will be aggravated by this climate-induced impact acting to confound the boundary between private property rights and the public trust lands.

A fifth much broader paper by Franklin Obeng-Odoom and John Sheehan explores the comparative impact of sea level rise and increased storm events occasioned by climate change on customary property rights in Ghana and Australia. Whilst there have been recent developments in environmental practice in both countries, most approaches to climate-driven impacts are "typically unidimensional" focussing on market failure. Property markets are anathemical to holders of inalienable Indigenous property rights which are historically not commodified demonstrating "the non-universality of the Western concept of property." Again in a familiar theme, they describe the vulnerable location of the Indigenous Ga people in Accra the capital of Ghana along the flood-risk coastline, exacerbated by "haphazard physical development including the construction of some buildings on water ways." Market-based strategies being pursued in Australia are described as part of "the current apathetic discourse and policy attitude adopted in relation to Indigenous lands" affected by climate change. Obeng-Odoom and Sheehan find the declining economic worth of Indigenous property rights in Ghana or Australia facing possible inundation from flooding or storm erosion is to be resolved by the bizarre expectation the indigenous property rights will cease upon submergence. The paper shows the massive deterioration in Indigenous property rights that can be anticipated with climate change.

The sixth more focussed paper by Ed Wensing, Sharon Harwood, Deanne Bird and Katharine Haynes continues the examination of climate change impact upon Indigenous lands, notably small remote communities in northern Australia. They assiduously inquire into the adequacy of "links between emergency management and land use planning" with the aim to ascertaining whether Indigenous commu-

nities are now more resilient to climate-driven disaster. They find there is no dissonance amongst these communities that climate change related sea level rise is already occurring, with the consequences "already apparent with erosion and saltwater intrusion in some coastal areas." However, the daunting array of intergovernmental responsibilities for disaster resilience is contrasted with the "significant omission" of focussed advice and support for Indigenous communities in the 2011 National Strategy for Disaster Resilience (NSDR). Similarly, in the 2011 National Indigenous Reform Agreement (NIRA) "disaster resilience in remote Indigenous communities is neither mentioned nor considered." Wensing, Harwood, Bird and Haynes look to land use planning to ensure climate change impacts in remote communities are properly addressed at least in the built form, however cadastral inadequacies amongst other issues have not resulted in NSDR priorities being translated into the desired disaster resilience through planning. Crucially, this disconnect is sheeted back to the underpinning Indigenous land tenure which does not appear to be included in the usual property databases which can incorporate hazard information. Disturbingly, they conclude small remote Indigenous communities in northern Australia currently do not have the "same levels of protection from the impacts of sea level rise and high tidal surges as are afforded" other Australian communities.

The last two papers in this issue offer a different approach to sea level rise and increased storm events, looking at climate change risk and how increased property obsolescence and reduced insurability will impact. The seventh paper by Garrick Small carefully takes the reader through the scale of anticipated sea level rise over the twenty first century, and cautions whilst "it is important to be realistic in addressing this problem, it is important to avoid excessive forecasts in either direction." He also questions somewhat contrarily whether increased storm events should be unquestioningly drawn as a climate change impact, but recognises a property with "an exposure to extreme sea related hazards is not likely to hold its land value." He sees this aspect as especially important in Australia where coastal lands have "amongst the highest residential values," and if they fell due to the perceived hazard blight the individual losses would be significant. Intriguingly, obsolescence of coastal properties is contrasted by Small with ghost towns whose economic basis has disappeared, and suggests the diminishing utility of coastal residential properties over the current century could be similar. He claims land use planning could ameliorate the risk of sea level rise, either by slowly reducing the private utility of threatened coastal lands, or strengthening less impacted properties through imposed civil engineering protection or more robust building regulations.

Last but not least, is the eighth paper by Lucy Cradduck and John Teale bears many similarities to the penultimate paper of Small. However, the prospect of sea level rise is set aside by the reality that populations globally are living increasingly in buildings located in flood-risk areas. They portray failed flood mitigation measures, and consider reliance on those efforts "is misguided". A better approach may be that seen in a progressive relocation of homes and businesses to higher land."

Access to relevant information is crucial if confusion is to be avoided, and risk recognised when property owners seek to insure their assets against the danger of flood. Cradduck and Teale argue the type and quality of such information still relies on the ability of the vulnerable property owner knowing what to ask of prospective insurers. The disastrous 2011 Queensland floods resulted in changes to Australian insurance laws establishing a mandatory definition of "flood", however critical terms like "actions of the sea" remain undefined by legislation and are not standardized causing potential for confusion and obviously potential for disputation. They point out land use planning is a slow acting tool, and the immediate issue is that of minimum cover insurance of vulnerable coastal and flood liable properties. As in other papers, financially vulnerable property owners are identified as being at greatest risk.

Questions raised by papers in this special issue focus on three main concerns related to the effects of sea level rise and increased storm events:

Defining the quantum of sea level rise and intensity of storm events

The prospect of sea level rise coupled with the increased frequency, duration and severity of storm events is already impacting on some coastal land, development and populations. Whilst within some polities there may be disputation as to the link with climate change, it is hard to avoid the evidence that well-resourced coastal property owners are in denial until they perceive their property rights threatened. At that point, they are able to marshal the State to protect their privileges at a public cost, irrespective of any risk measurement showing others more vulnerable. This potentially larger group of formal and informal holders of property rights is more immediately threatened and does not have such political influence or access to robust mapping and hence risk measurement, and remain vulnerable to the forces of nature.

Identifying the most vulnerable coastal interests

Corresponding to the variability of access to information, the question of identifying the most vulnerable coastal communities (from a climate-impacted standpoint) both physically and socio-economically remains open. Local land use planning relies heavily on the input of data sources often held by other levels of government (or agencies), and the fragility of the resource base of local government in turn threatens attempts to re-focus planning on the most vulnerable communities .

Strengthening local government as the key action agency.

Once the communities most effected by sea level rise and increased storm events are known, the ability of local government to protect their property rights (and other threatened interests) must *a priori* be established. Much hope is on the fitness of local government to undertake this task, however the results to date have not met

these sanguine expectations. The question of how local government can be strengthened for this task also remains open.

This special issue demonstrates property rights are never stable contrary to a broad public perception, and none now more unstable than those rights impacted by events in nature such as climate-driven sea level rise and increased storm events. While geographers and planners look to established patterns of practice to resolve many land use conflicts, climate-driven change presents the most problematic of all issues to be resolved; a task which future generations will look back at us with either admiration or dismay.

REFERENCES

Freyfogle, E.T. (2003) *The Land We Share: Private Property and the Common Good.* Washington DC: Island Press.

Hiatt, M. A. (2008) Come hell or high water: Re-examining the takings clause in a climate changed future. *Duke Environmental Law and Policy Forum*, 18: 371-397.

Mamouney, L. (2000) Should local government be responsible for biodiversity management? A critical review of local government's ability to manage biodiversity loss in NSW through the development process. *Environmental and Planning Law Journal*, 17(2): 138 – 150.

Mitchell, D. (2010) Land tenure and disaster risk management. *Land Tenure Journal,* 1.10: 122-141.

O'Donnell, T. and Gates, L. (2013) Getting the balance right: A renewed need for the public interest test in addressing coastal climate change and sea level rise. *Environmental and Planning Law Journal,* 30 (3): 220 – 235.

Renard, V. (2008), Property rights protection and spatial planning in European countries. In Ingram, G. K. And Hong, Y-H. (eds.), *Proceedings of the 2008 Land Policy Conference: "Property Rights and Land Policies"*, 216 – 229.

Resource Assessment Commission (1993), *Coastal Zone Inquiry: Final Report*. Canberra: Australian Government Publishing Service.

Sheehan, J. (2011), Rising sea levels – transferable development rights as alternative compensation. *Australia and New Zealand Property Journal*, September, 148 - 152.

Tonkin & Taylor Ltd. (2013), *Report: Christchurch City Council – Effects of Sea Level Rise for Christchurch City*. Christchurch: November.