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Kim S. Alexander, Anthony Ryan and Thomas G. Measham

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Further information: Bev Rose - [bev.rose@csiro.au](mailto:bev.rose@csiro.au)

CSIRO Ecosystem Sciences  
GPO Box 284, Canberra ACT 2601  
Australia  
[www.csiro.au](http://www.csiro.au)

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# Managed Retreat of Coastal Communities: Understanding Responses to Projected Sea Level Rise

Kim S. Alexander<sup>1</sup>, Anthony Ryan and Thomas G. Measham

## ABSTRACT

*Managed retreat - the relocation of homes and infrastructure under threat from coastal flooding - is one of the few policy options available for coastal communities at risk from sea level rise. A structured withdrawal from areas inundated by rising sea levels may be the only viable option for some jurisdictions and may be the most cost-effective defensive approach. At present, little is known about the attitudes held by Australian residents on possible managed retreat options. The authors explore peoples' attitudes toward a managed retreat option known as conditional occupancy land rights and whether compensation for land at future risk from sea level rise would be necessary. The authors present a meta-theoretical social functionalist framework to analyse the range of personal concerns and responses to proposed policy options for vulnerable coastal shorelines. Data from an online survey has been used to categorise respondents according to their social functionalist decision-making styles. The study has shown that individuals can act intuitively as scientists, economists, politicians, prosecutors and theologians when subject to situations of judgement and choice. The study compared the responses of climate change rejectionists and those unsure about the risks of sea level rise with those concerned about the risks of sea level rise. The research demonstrated that the majority of respondents considered the risk of sea level rise from multiple functional perspectives more often than from a single perspective. The findings reinforce the need for further public debate on how to respond to sea level rise, and emphasise that different individuals frame the purpose of those debates in distinct ways; to reach the most accurate, optimal and socially acceptable or morally appropriate response, depending upon what is inherently important to them dictated by their social functionalist position.*

Keywords: social functionalist theory, sea level rise, managed retreat, coastal management, climate adaptation

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<sup>1</sup> Social and Economic Sciences Program, CSIRO Ecosystem Sciences, GPO Box 284, Canberra ACT 2601, Australia

## INTRODUCTION

The current rate of sea level rise (SLR) is unprecedented in human history (Rahmstorf et al., 2007; Wjiffels et al., 2008; Woodworth et al., 2009). The threat of accelerated SLR presents coastal communities with a host of social, legal, economic and environmental challenges. In particular, the risk from SLR and storm surges to buildings and infrastructure and to coastal property values is expected to increase during this century (DCC, 2009; Nicholson-Cole and O’Riordan, 2009). Consequently, a challenge of coastal policy over the next decade will be to design and implement institutional arrangements that prevent and/or resolve legal, financial and social conflicts in areas threatened by accelerated SLR (Ryan et al., 2010). An important approach towards developing acceptable and fair SLR policies will be to engage the general public in decisions and engender debate. There are, however, a number of obstacles, associated with actively engaging the public in areas of controversy, which this paper will identify (Few et al., 2007a; Hance et al., 1988; Wandersman and Hallman, 1993).

While there is evidence indicating coastal populations are likely to be affected by SLR, the nature, timing and severity cannot be predicted with precision (Brooks et al., 2009). In addition, coastal communities may be confronted with non-linear climate change, with less predictable outcomes possible (Anderson and Bows, 2008; Lenton et al., 2008). Meanwhile, a significant portion of citizens currently dispute global warming estimates, biophysical effects and SLR predictions (Climate Institute, 2010; Hulme, 2009). Compounding this situation is that policy initiatives may place significant costs on specific coastal residents, businesses and infrastructure.

### *Managed Retreat Policy Options*

While there is increasing attention to climate adaptation planning, the implementation of policy options is still in its infancy (Tang et al., 2010). Three major SLR coastal policy goals with an attendant suite of policy options have been assessed in previous literature, including protection, accommodation and retreat (Bray et al., 1997; Few et al., 2007a; Klein et al., 2001). Protection implies prevention of impacts using hard and soft sea and river defences, such as sand replenishment or barrier construction. Accommodation is the reduction in sensitivity and/or exposure to the impacts, eg. flood proofing, drainage systems. Retreat involves major changes to land use and relocation of homes and infrastructure under threat (Few et al., 2007a). Planned retreat from the sea behind natural ecological defences can be an adaptation option and distinct policy goal. Land for colonisation by coastal ecosystems could be set aside, or buildings constructed on condition they are to be removed when the sea reaches a pre-specified distance from the structure (Abel et al., 2011).

It is expected that SLR policy toward high value locations and immovable assets in cities, will involve costly protection and accommodation strategies (IOC, 2009; Nicholson-Cole and O’Riordan, 2009). Elsewhere, however, there are two distinct advantages of retreat policies. Firstly, they tend to be less expensive. Secondly, the timelines for their implementation can be more flexible by providing a policy response to SLR prior to inundation or at other critical points where action may be required.

Managed retreat may be the most appropriate or cost-effective policy response for some locations, yet it could still come at significant cost. Consideration of managed retreat strategies for pre-existing coastal communities may increase market uncertainty and reduce land values. The distribution of these impacts could

lead to social inequity and compensation claims (Cooper, 2003). While a retreat option may provide benefits to the community compared to other SLR policies, potentially there will be higher costs for some individual property owners (Cooper and McKenna, 2008). Implementing a retreat scheme may also negatively affect the collective sense of place of members of coastal communities (Giuliani and Feldman, 1993; Fried, 1963). For example, Byron Shire Council, on the east coast of Australia, has been operating a zoning and development system with retreat clauses (options) to accommodate coastal erosion and the Bryon Shire Council planned retreat policy has been the topic of heated debate (Leitch, 2009). Retreat openly acknowledges the uncertainty of the future and involves a contingency plan that to some may be defeatist even if in reality the odds are insurmountable (Burton, 1994).

Managed retreat has historically been recommended to maintain coastal settlements and ecosystems vulnerable to development pressure and erosion prior to wide recognition of climate change impacts (Pethick, 2002; Shackley and Deanwood, 2002). Ecological barriers such as mangroves, reefs and wetlands offer protection to houses and infrastructure against the risks of storm surges and are cost-effective over the long-term compared to engineered solutions (Abel et al., 2011). In some locations ecological barriers can significantly reduce the rate of coastal erosion. As sea level changes, the habitats of coastal plants and animals are expected to shift landward (Lovelock and Ellison, 2007), so competition for space between development and coastal ecosystems is likely to intensify. Coastal ecosystems are, moreover, depleted by continuing and rapid urban encroachment as well as the indirect impacts of development, and would be less able to adapt to climatic change if simultaneously challenged by the impacts of development. An option for responding to the expected increases in threats from the sea is therefore

to protect coastal ecosystems from the direct and indirect impacts of development now, and maintain or create an environment to populate as the sea rises (Abel et al., 2011). Such a strategy has been labelled “rolling easements” (Titus, 1998; Titus and Narayanan, 1996). A major draw back of a rolling easement strategy (also known as managed retreat), is that people are required to forfeit their ownership of coastal front land years before their property will be inundated by rising seas. It is expected that many coastal residents will be reluctant to do so in order to mitigate erosion at their location (if not part of the original contract), unless they are adequately compensated and feel that the retreat scheme is transparent, fair and just (Few et al., 2007a).

This research paper explores community reactions to a hypothetical managed retreat scheme that requires residents to forfeit their land to make way for an ecological barrier when SLR reaches a designated point. The suggested managed retreat option scheme, Conditional Occupancy Rights (COR), has been based on the following assumptions; (i) that property owners were to be told about the scheme before they bought property, (ii) land was not previously built upon, (iii) future buildings were to be of appropriate design and (iv) the scheme was to be evident in the contract of purchase and a condition on the property rights.

#### *SLR Policy Development and Community Engagement*

The need for new SLR policies is emanating from concerns by scientific, legal, economic, and planning regimes that foresee the need to plan for and better manage emerging environmental risks (Ryan et al., 2010). Based on available science, legal precedents (eg. "Walker v. Minister for Planning", 2007) are already requiring governments, industry, coastal communities and individuals to incorporate the risks of SLR into their property-related decisions. The insurance industry has expressed

concern that the status quo approach under extreme climate change conditions such as sea level rise could bankrupt their industry (Coleman, 2003). Coastal urban planning departments are responsible for the replacement of urban infrastructure and ongoing decisions need to factor in climate change projections and SLR related risks (Walsh et al., 2004). Coincidentally, coastal authorities responsible for land release are becoming increasingly more risk averse, concerned about the possibility of future litigation. The solution of withholding tenable land from the market may not be the best solution, as the timeframes surrounding SLR are uncertain.

While government and many key stakeholders recognise the need for SLR policy approaches to be compatible with coastal urban planning (Humphrey and Burbridge, 2003; Warburton, 1998), there is strong evidence that unpopular coastal policies are unlikely to be successfully implemented (Tompkins et al., 2008). SLR policies need to attempt to ameliorate long-term risk thereby ensuring the sustainability and social function of communities. Policies designed to manage long-term risks tend to be controversial (Few et al., 2007a). Therefore, community involvement is central to the success of strategies for gaining public acceptance of schemes designed to reduce long-term risks (Alexander, 2010; Alexander et al., 2010; Moglia et al., 2010). The public therefore should be engaged in deciding how to manage the long-term risks of SLR and to determine the actions to be undertaken under various SLR scenarios (O’Riordan and Ward, 1997). However, public engagement is time consuming and expensive (Alexander, 2010; Larson et al., 2010) so it is important for policy makers to understand the range of community responses to threats and design appropriate engagement processes.

Of critical importance to decision makers, is knowledge of the decision-making criteria that property owners employ in order to make sense of SLR policy.

This paper explores whether individuals' perceptions of the risk of SLR influences their decision-making when assessing managed retreat scheme policy options. In order for a managed retreat policy not to exacerbate social, economic, legal and political conflicts, governments and councils must be able to understand the concerns of various constituents and engage in dialogue with the community. In the next section we outline different decision-making criteria that can be used to assess whether the COR scheme is acceptable. It is proposed that every person is capable of viewing the world intuitively through functionalist frameworks based on scientific, economic, political, prosecutor and theological decision criteria. The current study will empirically explore whether the type of decision criteria employed to assess the COR manage retreat policy is moderated by an individual's perceptions of SLR risk. Findings from the study suggest that individuals can use several decision criteria to support their viewpoints and which form their worldviews.

## USING FUNCTIONALIST FRAMEWORKS

How we respond to a particular situation depends largely on the goals and outcomes that we would like to achieve. Tetlock (2002) outlines five social functionalist frameworks (intuitive scientist, intuitive economist, intuitive politician, intuitive prosecutor and intuitive theologian) that describe behavioural strategies individuals are capable of using in order to cope with adaptive challenges they may face. The defining difference between each theoretical position is the underlying goal of the individual. In principle, all individuals are capable of acting and thinking in each functional framework when motivated to serve a functional purpose (Tetlock et al., 2000). Even so, different functionalist frameworks are used at various times in a persons' life (Tetlock, 2002). When environmental planning and management is based primarily on science and economics, the policy framework can struggle to

make sense of reactions such as outrage, discussions of immorality, taboo and fairness concerns (Hance et al., 1988). Tetlock (2002, p.454) claims difficulties arise when:

The scientist's quest for the truth is subordinated to the politician's need to craft compelling justifications; the economist's calculus of self-interest is checked by the theologian's obligations to communally shared values; the scientist's curiosity about the causes of behaviour is qualified by both the prosecutor's determination to hold rule breakers responsible and the theologian's desire to block inquiry that demystifies objects of veneration.

Tetlock (2002) proposed that traditional decision-making theories have assumed that operating as a scientist and/or economist maximises an individual's ability to meet life's challenges as they arise. Tetlock (2002) also proposes that the majority of people under certain conditions also act as theologians, prosecutors and politicians, as greater benefit may be personally accrued by not only relying upon scientist or economist decision criteria. Tetlock (2002) proposes that each social functionalist framework is associated with particular perceptions, cognitions, emotions and behaviour.

The authors suggest that decision makers responsible for developing and implementing SLR policy may greatly benefit from understanding the differences between functionalist decision-making criteria and positioning and through awareness of the social groups most likely to employ each decision-making framework. The five frameworks are described below.

**Intuitive Scientists:** The intuitive scientist is driven by epistemic goals and the need to discover causal relationships, always value-neutral in pursuit of truth. Intuitive

scientists attempt to avoid inferential errors, and ideally protect their self-esteem, while restoring cognitive consistency, and affirm belief in a controllable world (Friedrich, 1993; Tetlock, 2002). In the domain of SLR policy assessment, intuitive scientists are concerned with developing an understanding of future SLR scenarios and associated risks. For example, what are the risks? What are theories that could explain SLR? What are the past and forecasted SLR trends? What does the current scientific literature conclude about SLR? While the purpose of the intuitive scientist framework is to learn more about the world there have been countless examples of scientific theories found to be incorrect. An intuitive scientist should not be construed as an individual who knows the “facts” about SLR, but rather as a knowledge seeker looking to learn more.

**Intuitive Economists:** The intuitive economist is driven by goals of maximising the benefits of resource use for themselves and/or the community. An intuitive economist holds a utilitarian ethic, where rational human decision-making is conceived in terms of trade offs, specific costs and benefits. The utilitarian ethic approach defines instrumental value flowing from the consequences of an outcome as “good”, while instrumental non-value is defined as “bad” or non-preferred (Spash, 2000a; Spash and Simpson, 1993). Intuitive economists rely on cost-benefit-analysis (CBA) procedures outlining the most “rational”, “best”, or “optimal” decisions. The CBA’s employed by economists usually assess various consequences according to a unifying utility principle, where a higher level of some resulting end state – monetary profit, pleasure, happiness, welfare – is deemed to be the decisions maker’s objective (Spash, 1993). In the case of SLR policy the goal of the intuitive economist is to choose the most economically optimal option. For example, “How much is a property with a COR retreat clause worth? What is the

financial risk of purchasing a house with a COR clause? What SLR policy would be most economical for society?”

**Intuitive Politicians:** Intuitive politicians describe individuals who are attempting to cope with accountability demands from key constituencies in their lives. The intuitive politician needs to establish or preserve a desired social identity and possess a reasonably reliable mental compass for navigating the self through role–rule structures. For example, the intuitive politician is aware of whom they must answer to, for what they must answer and on what grounds. There are various behavioural strategies for intuitive politicians involving pre-emptive self-criticism and defensive bolstering (Semin and Manstead, 1983; Stryker and Stratham, 1985; Tetlock, 2002). The driver for any behavioural strategy, however, is to maintain a positive image and to escape the possibility of accountability. In the context of SLR policy, an intuitive politician may hold a belief that a managed retreat clause is necessary, but may also be pleading for the clause not to affect him/her personally or to be otherwise entitled to just compensation.

**Intuitive Prosecutors:** The goal of the intuitive prosecutor is to enforce social norms by directing accountability demands on those tempted to derive the benefits of collective interdependence without contributing their fair share or without respecting the role–rule regime (Tetlock, 2002; Tetlock et al., 2007). The primary concern of the intuitive prosecutor is to protect him/herself or others from exploitation. If an intuitive prosecutor believes that a norm violation is common and often goes unpunished, their goal will be to put pressure on those responsible to tighten standards of accountability, reject excuses and justifications for norm violation, and try to close loopholes (Cosmides and Tooby, 1994). There is strong psychological evidence that while most people see themselves as fair-minded with adherence to

shared norms of fair play, humans have a tendency to be roused to retributive wrath when others display contempt for these norms (Lerner and Lerner, 1978; Miller and Vidmar, 1981; Tetlock et al., 2007). For example, there may be concerns that a retreat policy could be undermined by political backsliding or that people will refuse to retreat when required to do so. Individuals who are sceptical and reject the science of SLR may also demand that resources be directed away from managed retreat towards other concerns which are seen to be more legitimate.

**Intuitive Theologians:** Intuitive theologians try to protect sacred values from secular encroachments. They have a need to believe that the prevailing accountability and social control regime is not arbitrary but rather flows naturally from an authority that transcends accidents of history or whims of dominant groups (Durkheim, 1976; Tetlock, 2002). Intuitive theologians will attempt to block inquiry that demystifies objects of veneration and will fight to protect sacred values from encroachments such as market capitalism, government laws and scientific naturalism. Smithson (1989) suggests that the concept of taboo holds interest for any researcher who intends to understand more about cultural responses to uncertainty. Punishing socially sanctioned taboo rules that involve anger will be evoked when breaking a taboo is even being considered, let alone acted upon (Lichtenstein et al., 2007; Tetlock et al., 2000).

While the intuitive theologian response may appear extreme, we all are capable of a taboo reaction if our deepest beliefs are challenged. For scientists, the burning of books, the suppression of ideas or discussing the supernatural (Hodges, 1974) may evoke a taboo reaction. Environmentalists can become offended if monetary terms are applied to deeply-valued heritage sites that they believe have a non-negotiable right to exist (Spash, 2000b, 2002; Spash and Hanley, 1994). In

terms of SLR policy, an intuitive theological reaction to accelerated SLR might be an outright rejection on principle, or becoming incensed that a COR scheme might require an individual to be forced off and relinquish their property.

### *Community Engagement*

SLR risk perceptions represent different social functionalist frameworks; therefore an awareness of these differences may develop and interrupt community engagement processes. While experienced community planners and environmental managers accustomed to community engagement processes may recognise these functionalist roles, the framework we propose here provides a mechanism to explicitly recognise peoples' responses and communicate appropriately with citizens as well as with colleagues, all of whom innately hold intuitive functionalists positions. A deeper understanding of these positions could assist with dialogue, understanding topics to be addressed and the deep concerns of different stakeholder groups. Moreover, the framework can be useful to understand the various aims and strategies of different segments of community by focusing on the functionalist frameworks they employ. SLR and the COR scheme are complex topics and it is even possible that people can draw upon more than one worldview when discussing these issues.

In the next section we show how climate rejectionists, believers and the unresolved employ different functionalist frameworks to support their positions when asked about the establishment of a COR scheme to defend against SLR. The manuscript will also explore whether citizens draw upon a mixture of functionalist frameworks to help them achieve their objectives in regards to SLR policy or whether they prefer to use just a single worldview approach.

## METHOD

### *Survey Recruitment Process*

The authors observed that some studies reporting stakeholder perceptions of climate change favour responses of environmentally aware respondents, indicating a selection bias (see Shackley and Deanwood, 2002). To avoid such bias, respondents were recruited across Australia via advertisement on Google over a 3 week period in June and July 2010. A media release was reported in six regional newspapers, and the survey was highlighted in radio interviews. Furthermore, the survey was featured on several website blogs, including those presenting rejectionists opinions about accelerated SLR, directing viewers to the survey website. The online survey was an exploratory method aimed at eliciting a wide range of frank opinions on SLR in relation to coastal property. The sampling methodology consisted of self-selected respondents rather than those representing a stratified random sample. Hence, the responses from the sampled population cannot be regarded as representative of Australian populations or of coastal communities. However, the methodology was able to gather a wide range of views on the topic from computer-literate members of the community motivated to voice their opinions about SLR policy. Details of the online survey are reported by Ryan et al., (2010).

### *Respondents*

In total, 524 respondents completed the survey. Due to the politically controversial topic of the survey, responses were screened for false data, with two cases eliminated for inconsistent and off-topic responses. However, respondents were not excluded for expressing anger or discontent about the survey as the social

functionalist framework (Tetlock, 2002) offers explanations as to why respondents might express their anger.

### *Survey Methodology*

The survey consisted of four pages of questions. The first page administered property purchase questions; the second questioned perceptions of sea-level rise and general policy options; the third asked respondents to assess a managed retreat scheme called a “conditional occupancy rights scheme”. The fourth page collected demographic information.

### *Open-ended Survey Questions*

While the survey predominately administered closed-ended quantitative questions, five open-ended questions were used to classify the respondents into social functionalist categories. Three of the open-ended questions referred to the COR scheme, asking respondents:

- Why they agreed or disagreed with the statement that “people should be concerned about possible sea level rise when purchasing a property near the coast”
- Their concerns about the COR scheme, “If planning to buy a property near the coast, would you consider buying a property with a Conditional Occupancy Rights scheme that is under the condition that you had to vacate the property if the sea rises to a pre-defined level?”
- Their attitudes towards acceptance, “Can you think of any changes to the Conditional Occupancy Rights scheme that may make people more likely to accept them?”

- Their emotional response, to quantitatively assess whether they felt angry when reading about the Conditional Occupancy Rights scheme. Respondents that responded angrily were asked “Why?”
- Their additional thoughts and responses, “Do you have any comments about the survey?”

#### *Classification of Respondents into Functionalist Categories*

Of the total respondents, 462 (89%) were classified into one (eg. intuitive scientist) or a combination (eg. intuitive scientists and intuitive theologian) of the five categories based on their responses to the five qualitative questions. Of the total respondents, 60 (11%) provided responses which were inconsistent with any of the functionalist categories and hence were not classified. Classifiable answers positioned respondents according to the following pre-defined criteria:

##### Intuitive Scientist Classification Criteria:

A respondent was classified as an intuitive scientist if their qualitative responses:

- Mentioned scientific evidence to justify their SLR belief
- Referred to past SLR trends
- Referred to forecasted SLR trends
- Discussed a theoretical cause of SLR
- Referred to their personal experience.

##### Intuitive Economist Classification Criteria:

A respondent was classified as an intuitive economist if their qualitative responses referenced SLR policy or housing purchase decisions and:

- Referred to monetary value when assessing property or SLR policy
- Discussed compensation incentives
- Discussed utility, supply or demand

- Mentioned the relationship between resource constraints, market forces or other factors (eg. risk, uncertainty or fairness).

#### Intuitive Politician Classification Criteria:

Respondents were classified as an intuitive politician if they:

- Attempted to justify their position on SLR policy against an alternative course of action
- Their argument acknowledged the legitimacy of raising an alternative course, but through a socially persuasive argument they conclude their position must be defended.

#### Intuitive Theologian Classification Criteria:

Respondents were classified as an intuitive theologian if they:

- Attempted to defend their sacred values or beliefs from secular encroachment
- Suggested some questions should never be asked
- Demonstrated unbounded and infinite commitment in their beliefs about SLR, while making harsh trait attributions (eg. idiots) to those who disagreed with their position
- Demonstrated moral outrage for positions that contradicted their norms.

#### Intuitive Prosecutor Classification Criteria:

Respondents were classified as an intuitive prosecutor if they:

- Expressed concern about the dishonesty of others
- Suggested a strategy to prevent people from free-riding
- Demonstrated a desire to place accountability demands
- Showed concerns about social justice.

## RESULTS

Two researchers independently classified respondents into functionalist categories based on the classification criteria listed above. Cohen's kappa was the statistic used to assess the degree of agreement between the two researchers' classifications. Landis and Koch (1977) argue that Cohen's kappa values  $< 0$  indicate no agreement; 0–.20 indicate slight agreement, .21–.40 fair agreement, .41–.60 moderate agreement, .61–.80 substantial agreement, and .81–1 almost perfect agreement. The inter-classification reliability for each of the functionalist categories was: Intuitive scientist kappa = .62; Intuitive economist kappa = .62; Intuitive politician kappa = .18; Intuitive prosecutor kappa = .70; Intuitive theologian kappa = .65. All of the classifications were found to have substantial inter-classification reliability, with the exception of the intuitive politician classifications. Where there was a differing classification of the respondent responses the researchers conferred, and mutually agreed upon a classification decision.

### *SLR Risk Perceptions*

The survey included four quantitative closed-ended items that assessed the perceptions of risk regarding SLR. The four items formed a scale with a high level of internal consistency (Cronbach's  $\alpha$  of .95). The scale distribution was bimodal, with a large number of respondents either very concerned or not at all concerned about the risks of SLR. In order to examine the functionalist worldviews of respondents it was decided to classify respondents into a "concerned about SLR risks" group ( $n = 177$ ) and a "rejectionist of SLR risks" group ( $n = 277$ ). Respondents who were not at extreme ends of the survey were classified into an "unsure of SLR risks" group ( $n = 81$ ). Clearly, there were major differences between respondents who rejected the

predictions of accelerated SLR and those who were extremely concerned about such predictions.

### *Sample Demographics*

Table 1 displays the demographics for the three SLR risk perception groups. There were a significantly higher proportion of males “not concerned” (or “rejectionists”) of SLR risks compared to the other risk perception groups,  $\chi^2 = 44.91$ ,  $df = 2$ ,  $p < .01$ . The “not concerned” group tended to have slightly older members ( $\chi^2 = 12.97$ ,  $df = 4$ ,  $p < .05$ ) and were more likely to own a property near the coast ( $\chi^2 = 6.61$ ,  $df = 2$ ,  $p < .05$ ). There was a significant difference between the SLR risk perception groups in levels of education,  $\chi^2 = 15.35$ ,  $df = 6$ ,  $p < .05$ , with a significantly lower proportion of concerned respondents highest level of education being a technical degree. There were no significant differences between the SLR risk perception groups in distance lived from the coast ( $\chi^2 = 3.97$ ,  $df = 6$ ,  $p > .01$ ) or income ( $\chi^2 = 8.74$ ,  $df = 6$ ,  $p > .01$ ).

TABLE 1 ABOUT HERE

### *Functionalist Worldviews*

While the majority of respondents provided detailed information when responding to the open-ended questions, some responses were quite brief or in some instances there was no response recorded. Those classified into at least one functionalist worldview category included 248 (94%) of the “unconcerned” rejectionists group, 63 (78%) of the “unsure” group and 149 (84%) of the “concerned” group.

Figure 1 displays the percentage of respondents from each SLR risk group classified into each functionalist category. The upcoming analysis will conduct  $\chi^2$  tests to compare the expected and observed frequencies of classifications into intuitive worldviews for each of the SLR risk groups. As respondents could be

classified into multiple worldview it is not possible, however, to use a  $\chi^2$  test to compare expected and observed frequencies of SLR risk groups across the five worldview classifications as this would violate the assumption of independence (eg. respondent must not belong to more than one cell).

#### Intuitive Scientists

More than half the respondents from each of the SLR risk profile groups were classified as intuitive scientists. The three SLR risk groups did not differ significantly in their frequency of intuitive scientist classifications,  $\chi^2 = 2.52$ ,  $df = 2$ ,  $p > .05$ . This suggests that all three SLR risk groups were equally likely to discuss scientific evidence, past or forecasted SLR trends, theoretical causation or discuss their personal experience. Table 2 provides examples of intuitive scientist quotes for each of the three risk profile groups. These quotes reveal that both individuals who are “concerned” and those who “reject” the risk of SLR are scientifically literate.

*FIGURE 1 ABOUT HERE*

*TABLE 2 ABOUT HERE*

#### Intuitive Economists

Figure 1 displays the percentage of respondents from each of the SLR risk profile groups classified as intuitive economists. A significant difference was found between the frequency of intuitive economists classifications for the three SLR risk groups,  $\chi^2 = 74.85$ ,  $df = 2$ ,  $p < .001$ . The “rejectionists” group were much less likely to discuss the economics than the other two SLR risk groups. A third of the “rejectionist” intuitive economists referred to the possibility of benefiting from a retreat clause. They foresaw benefits from lower prices, without expecting to have to relocate as specified by the contract. For example, two respondents claimed, “As this science is

totally unproven, I am sure that properties listed like this will be sold for well under their normal price” and “The property may be cheaper due to a scenario (SLR) which is very unlikely to occur”.

Respondents from the “concerned” and “unsure” group did not address the possibility of economically benefiting from a perceived non-event, where relocation was unlikely. Intuitive economists who were “concerned” or “unsure” about climate change were more likely to express concerns about compensation (“need full compensation upon relinquishing any part or all of the property”), the economic details of the retreat contract (“Guaranteed buyback price, indexed to cost of living or other valid index”), economic risk (“Lack of confidence about the fate of a very significant investment or asset”), weighing up the costs and benefits (“I would balance the purchase price with the benefits I would receive from living there in the short to medium term”), readjustment of market (“Values of overpriced waterfront land would go down”) and concerns about resale value (“Would affect resale value, best to buy high and dry”). It is possible that many of the respondents rejecting SLR found it difficult to discuss economics as they did not consider climate change as a risk.

#### Intuitive Politicians

Figure 1 indicates few respondents were classified as intuitive politicians. Only 4 “rejectionists”, 7 “unsure” and 7 “concerned” respondents were classified as politically driven. This suggests that at this point respondents are not inclined to justify their personal risk perceptions towards SLR to a legitimate authority.

#### Intuitive Theologians

Figure 1 indicates “concerned” and “rejectionist” respondents were much more likely to be classified as intuitive theologians than the “unsure” group. A significant

difference was found between the frequency of intuitive theologian classifications for the three SLR risk groups,  $\chi^2 = 138.93$ ,  $df = 2$ ,  $p < .001$ . Many “rejectionists” were not comfortable discussing a retreat option. Discussions on SLR caused angry responses from these respondents. A number of “rejectionists” believed it was morally wrong to publicly discuss the contributions of humans to climate change (“Only a communist country would suggest this!!! The theory of man made global warming is rubbish”), that the sea levels might be rising (“Rising sea levels are a load of hogwash, as is all that rot about man-made global warming”) or that we should be attempting to reduce our impact on the environment (“Climate change ALWAYS happens. We cannot stop it. Any thought to this via emissions control is stupid”). Other “rejectionists” were morally outraged at the prospect of a retreat scheme (“That sort of scheme is not right for our freedoms here in Australia”) or the logic of retreat (“Stupid idea as it assumes sea levels will rise”).

There were several “concerned” respondents who demonstrated intuitive theologian logic to argue that it is morally wrong to further develop land near the coast (“Buying a property in an environmentally fragile area such as right on the coast ... is both immoral and financially reckless...”) or that it may be wrong to deny SLR.

#### Intuitive Prosecutors

Figure 1 also displays that a larger percentage of “rejectionists” were classified as intuitive prosecutors. A significant difference was found between the frequency of intuitive prosecutor classifications for the three SLR risk groups,  $\chi^2 = 111.27$ ,  $df = 2$ ,  $p < .001$ . There were a host of reasons why respondents were attempting to make other parties accountable in the SLR policy debate. Many people were concerned about too much government interference (“The government would most likely have it

written so the property owner was ripped off and was left greatly undercompensated”) or they expressed distrust in government (“I am afraid that an incompetent government that can’t put batts in ceilings or build a school canteen for under \$800,000... could be trusted to implement such a scheme”). There were concerns that local government would attempt to deny liability (“Local government for covering their own backsides with no plans but happy to put notices on 149 certificates”) or that any discussion of SLR retreat policy would impact or hurt individuals (“That the wild, unsubstantiated claims cause concern and public and property values will suffer because of it.”). There were concerns about the retreat policy violating land rights (“It is my property, and the sooner all levels of government get their hands out of my pockets, and their unfounded beliefs out of my life, the better”) or with dishonest/opportunistic business people (“Conditional Occupancy Rights relies on the real estate agent being honest...”).

The SLR science (“Anthropocentric Global Warming is a total scam. Sea levels have risen since the end of the last glacial period of the ice age we are currently in”) and scientific institutions supporting SLR (eg. “CSIRO has shown a strong bias to fabricating unfounded alarm about global warming”) were also challenged. Intuitive prosecutor arguments put forward by “concerned” respondents included the argument that government should stop development (“That Councils would be so stupid as to allow people to live by the sea when they would be placing their lives and others in danger”) or that current owners will not accept responsibility (“If you are buying near the ocean you should realise the consequences and not play dumb”).

### *Multiple Social Functionalist Worldviews*

Social scientists often apply a conceptual framework to make sense of community motives that reflects only one of the social functionalist worldviews. For example, scientists assume that people are driven by knowledge, while theologians put forward moral claims. It is not clear, however, whether people perceive a complex issue such as SLR with a single functionalist worldview or whether they are able to combine functionalist worldview approaches. For example, a scientist/theologian may be motivated to learn more knowledge about what they deem to be morally right.

An exploratory analysis was conducted to examine the prevalence of combined functionalist worldviews. While any results are preliminary at this stage, it is hoped that such an exploratory analysis can provide future policy relevant research questions. A better understanding how people combine functionalist worldviews has potential to contribute to the community engagement process by helping clarify the motives of different stakeholder groups. Of the total respondents, 147 (32%) were classified into only one functionalist worldview, while 315 (68%) were classified into more than one. Table 3 displays the percentages of respondents classified into each worldview combination for the three SLR risk groups.

#### *TABLE 3 ABOUT HERE*

Examples of comments of the most popular multiple worldviews are presented as follows:

Scientist/Economist: “Depends on price.... I believe that sea level rise is to be expected. I therefore would be unlikely to buy a property for long term ownership.... Predictions and modelling is showing increased risk from climate change”.

Science/Economists/Prosecutors: “Larger storm surge is more likely - existing insurance provisions maybe inadequate. Buyer contracts should contain strong risk declarations. Then it is up to the buyers, sellers and insurance industry”.

Theologian/Prosecutors: “I trust that the instigators of this fraud will be duly prosecuted and punished”.

Scientist/Theologian/Prosecutors: “The assumed certainty that sea levels will rise found within this survey is disturbing, because as any geology undergrad would be aware, we're overdue for an ice age, in the event of which sea levels would drop significantly....I think it is unacceptable to anyone who uses common sense... That isn't science that is propaganda”.

## DISCUSSION

The threat of accelerated SLR presents coastal communities with a host of social, legal, economic and environmental challenges. Managed retreat has historically been recommended to maintain coastal settlements and ecosystems vulnerable to development pressure and erosion. Understanding more about attitudes held by Australian residents on possible managed retreat options is now of utmost importance to assist in environmental planning and forming management strategies. This study has shown that individuals can act intuitively as scientists, economists, politicians, prosecutors and theologians when subject to situations of judgement and choice. The study has also found that individuals can be driven by their multiple perspectives and intuitively act from combinations of social functionalist positions

when assessing the risk of SLR and the best options to deal with the consequences of SLR on vulnerable coastlines.

In this study, online survey responses were primarily from climate change “rejectionists” and hence cannot be regarded as a random sample of personal attitudes, though it does allow for greater insight into their expressed opinions. Samples from the Climate Institute (2010) online survey found that a majority of Australians were concerned about climate change to some degree, though the trend was decreasing. Online survey research by Leviston and Walker (2010) found that most people thought climate change was happening, although there was a lack of consensus about its cause, with fewer considering it to be human-induced. So whilst this online sample may not be as representative the rich detail of qualitative responses provide valuable insights into strongly held positions.

In this study, “rejectionist” respondents appear to be currently challenging the mainstream science and challenging the need for development of new policy on SLR. Hamilton (2007) indicates that community members who reject the science of climate change are becoming increasingly politically active and vocal in public debate. A survey conducted by the Climate Institute (2010) concluded that there has been an increase in the proportion of people who do not trust the science of climate change. The survey in August 2010 reported 23% believed climate change was due to natural causes, which is an increase from 16% in August 2009. The August 2010 survey also found that 17% of those surveyed said that they do not trust the science at all (Climate Institute, 2010). Leviston and Walker (2010) found that people tended to trust their friends and family for information on climate change.

### *Public Engagement Strategies*

The main mechanism for public engagement on coastal impacts of climate change to date has emphasised small-scale interactions such as workshops employing qualitative methods to elicit and compare stakeholder perspectives (Blackstock et al., 2009; Few et al., 2007b; Measham et al., 2010). These processes are crucial to understand which issues matter and to whom. Yet as Tompkins et al. (2008) claim, small-scale interactions cannot be assumed to represent the preferences of entire communities. A major challenge recognised in the literature on engagement and climate adaptation concerns deciding who does and who should participate in a given context (Few et al., 2007b). Without attention to this issue, policy makers and planners may find they have a selection bias such as a predominance of climate concerned respondents (Shackley and Deanwood, 2002). A key strength of the functionalist frameworks survey presented in this article is to help identify the range of positions held by community members and to provide a context in which to interpret whose opinions may be over or under represented in any given engagement process.

The framework presented in this study can assist environmental planners and managers to understand and anticipate some of the interests, strategies and conflicts which may arise during an engagement process. This is not to suggest avoiding conflict, rather to help understand what types of concerns (worldviews) may arise during an engagement process and what types of responses (worldviews) might be sought from planners and managers by different segments of the community. In this way, functionalist frameworks can assist in understanding that some community members might prefer optimising opportunities, others scientific arguments whilst still others will insist that equitable concerns are aired. This implies

a need to be cognisant of the benefits of using ‘top-down’ and ‘bottom-up’ approaches and the need to provide information and organise processes to fit with worldview preferences (Tompkins et al., 2008). In particular, the authors propose that community dialogue on managed retreat focussing on science and economics; will not satisfy the trepidations of a significant portion of the population who may be more concerned about fairness, processes and morality concerns.

The results suggest a different community dialogue for respondents with different concerns about the risk of SLR. Most of the respondents “concerned about the risk of SLR” were interested in talking science and/or economics. These respondents could be classified as having a “solution orientation” to the SLR issue. When engaging with the “concerned” group the key position would be to discuss the different risks posed by SLR, potential solutions and options for different SLR scenarios. Respondents who are “unsure” about SLR would require more balanced information about the potential SLR threat and the link between science and economics. Those within the “unsure” group would be better served by establishing rules that ensured SLR policies would not result in advantageous positions for selected groups, rather they would be reassured by a transparent and equitable solution. Engagement with this group would require education and information about the economic and scientific consequences while also discussing ways to ensure people do not unfairly benefit from changes to policy. Without discussing ways of ensuring fair and just processes people who are “unsure” about SLR risks may not be satisfied with community dialogue.

Only a small number of respondents rejecting SLR risks discussed science or economic criteria in isolation. This group are more likely to be concerned with moral or honesty issues. While the “rejectionists” group demonstrated an ability to draw

upon sophisticated scientific evidence to counter claims of SRL, they were not open to the possibility that SLR risk is a policy relevant issue. Many respondents insisted that SLR be dropped from the policy and funding agenda. The “rejectionists” group was extremely selective in what they considered to be science and were not willing to acknowledge the legitimacy of any scientific evidence that indicated accelerated SLR. Policymakers on the other hand are required to respond to available scientific analysis and cannot easily dismiss the risks of SLR. Any SLR policy such as managed retreat will possibly bring policymakers into direct conflict with this “rejectionists” group. If SLR does not occur, people who invest in a managed retreat scheme should benefit over the long-term, as they will have purchased a discounted property to which the threatened SLR did not eventuate. Interestingly, few “rejectionists” were willing to even contemplate a managed retreat scheme. Engagement with people over SLR requires understanding and respect for sacred norms and taboos. We suggest that acknowledgement is due to “rejectionists” respondents who may be protecting their sacredly held values and their angry responses cannot necessarily be interpreted as crazy, deluded or ill-informed.

The authors propose that efforts should continue to communicate science and economics, with awareness that such discourses are integral and necessary to public debate; however this alone will not suffice for community engagement about managed retreat. Additional information presented for different worldviews is required, in a form that does not challenge strongly held opinions, but rather acknowledges personal positions, thereby opening the possibility of continued dialogue, consensus building and public debate on options and scenarios of future actions and policies.

## CONCLUSION

The social functionalist framework presented in this paper provides a valuable tool to assist planners and managers understand more about the kaleidoscope of public opinion and to design better ways to engage with coastal communities. The social functionalist framework has been developed to complement small-scale, deliberative processes which have been used to engage with coastal communities in discussions and planning for adaptation to possible future impacts of climate change. A key strength of the functionalist frameworks analysis presented in this article has been to identify the range of positions (more than one worldview) that can be held by members in a community and to be cognisant of the importance of firmly entrenched beliefs, and hence how to engage in suitable dialogue. The framework presented here can assist environmental planners and managers to understand and anticipate some of the interests, strategies and conflicts which may arise during an engagement process and to address the conundrum by approaching concerns with a greater understanding of what may be driving the protest and what may be required to inform and appease special interest groups when planners and managers are developing policies that may affect different segments of the community.

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Table 1. Demographic details of the three sea level risk groups

Respondents	Unconcerned rejectionists of risk (n = 264)	or Unsure about slr risk (n = 81)	Concerned about slr risk (n = 177)
Gender**	86% Males 14% Females	69% Males 31% Females	58% Males 42% Females
Age*	7% <=35 years 76% > 35 < 65 years 17% >= 65 years	14% <=35 years 66% > 35 < 65 years 20% >= 65 years	15% <=35 years 75% > 35 < 65 years 10% >= 65 years
Highest level of education*	11% High School 24% Tech degree 28% Undergrad 37% Post-grad	11% High School 24% Tech degree 24% Undergrad 41% Post-grad	13% High School 10% Tech degree 35% Undergrad 42% Post-grad
Income before Tax	18% <\$50,000 34% \$50,001-\$100,000 21% \$100,001-\$150,000 27% >\$150,001	24% <\$50,000 35% \$50,001-\$100,000 23% \$100,001-\$150,000 17% >\$150,001	23% <\$50,000 39% \$50,001-\$100,000 21% \$100,001-\$150,000 16% >\$150,001
Owned a property near coast*	58%	53%	46%
Distance of residence to Coast	29% <1km 23% 1-5km 15% 5-10km 34% >10 km	33% <1km 19% 1-5km 16% 5-10km 32% >10 km	25% <1km 18% 1-5km 18% 5-10km 38% >10 km

\*\*Demographics different at a .001 level

\*Demographics different at a .05 level

Table 2. Scientific quotes by “Concerned” and “Rejectionists” respondents about risks of SLR

Intuitive scientific information	Quote
Scientific evidence	“Professor [name removed] of ... University has found that what sea level rises have occurred over the past fifty years have been at most negligible” (Rejectionist A)
Reference to Past trends	“Evidence and the consensus from CSIRO, BOM, IPCC, NASA etc and respected scientific organisations throughout the world support anthropogenic climate change” (Concerned A) “CSIRO data on ocean levels at numerous stations around Australia reveal little change in past 10 years” (Rejectionist B) “International research has for several decades established the pattern of global warming...compounding effects occurring throughout ice-caps, glaciers, and oceans” (Concerned B)
Reference to predicted trends	“Once again the whole scheme is based on computer modelling using the Wong ( Senator Wong) exaggerated baseline of 1.1 metre” (Rejectionist C)
Theoretical causation	“We are on track for at least 1m rise in thermal expansion of oceans, and near or past irreversible tipping points in the local feedback systems governing the stability of Greenland and West Antarctic icesheets” (Concerned C) “Once the long term fluctuations of climate are added to the mix and other possible influences such as the sun and solar radiation then the models give very different outcome” (Rejectionist D)
Personal experience	“Climate change is real and is caused predominantly by human driven factors including but not limited to deforestation and burning of fossil fuel” (Concerned D) “I haven’t seen, nor have any of my relatives, any visual changes in sea levels at all in our lifetimes. The beaches still look exactly the same as they did when I was a child” (Rejectionist E) “Having witnessed changes in coast lines in North Carolina, I am very concerned that many beach front properties will be ocean front in the upcoming decade without extreme intervention such as beach re-nourishment programs” (Concerned E)

Table 3. Classification of respondents into one or more social functionalist worldviews

Worldviews	Rejectionist	Unsure	Concerned
<b>One worldview</b>			
Intuitive scientist only	5.2%	7.9%	16.8%
Intuitive economist only	2.0%	14.5%	19.5%
Intuitive politician only	.4%	.4%	.7%
Intuitive theologian only	2.8%	0%	3.4%
Intuitive prosecutor only	8.1%	17.7%	8.8%
<b>Two worldviews</b>			
Science/Economist	2.4%	12.7%	16.8%
Science/prosecutor	5.6%	6.4%	7.4%
Economist/prosecutor	2.0%	6.4%	2.7%
Theologian/ prosecutor	25.4%	6.4%	2.7%
Other two worldview combination	2.0%	6.4%	4.5%
<b>Three Worldviews</b>			
Science/economists/prosecutor	4.0%	14.5%	7.3%
Science/theologian/prosecutor	32.2%	1.7%	2.7%
Other three worldview combination	2.0%	3.3%	4.7%
<b>Four Worldviews</b>			
Science/economist/theologian/prosecutor	4.8%	1.7%	2%
Other four worldview combination	1.1%	0%	0%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Figure 1. Percentage of responses from the 3 SLR groups categorised into each functional worldview.

