



Contents lists available at ScienceDirect

# Environmental Science and Policy

journal homepage: [www.elsevier.com/locate/envsci](http://www.elsevier.com/locate/envsci)

## Who defines atoll ‘uninhabitability’?

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### ARTICLE INFO

#### Keywords:

Habitability  
Uninhabitability  
Atolls  
Relational security  
Oceania

### ABSTRACT

This paper argues that the concept of ‘uninhabitability’ in the context of sea level rise risk is culturally and socially experienced and open to multiple truth claims, with implications for what we call relational security. In reference to the atolls of Oceania, non-local knowledges of uninhabitability have coalesced into ostensible truths about the inevitable relocation of atoll people. Yet uninhabitability and habitability arguably remain contested signifiers, with open possibilities for conceptualisation and thus for planning for the trajectory from habitable to uninhabitable. Far from being neatly universalizable for environmental security studies or cognate fields such as adaptation science, the qualities that make a particular place acceptable to live in are culturally and historically specific, involving local knowledges, cosmologies and place attachments. Habitability is thus irreducible to material elements of human security such as housing, food and water. The concepts of habitability and uninhabitability need to be recognised in research and policy as relational, situated concepts, and questions must be asked about who can and should define habitability in particular places. We argue that climate-exposed atoll populations have the right to have their experience and knowledge of habitability - and their perceived thresholds of uninhabitability - central to science, law, policy and planning that seeks to address sea level rise risk. We introduce the idea of relational security among climate-exposed populations which may be advanced through the process of articulating and institutionalising both habitability and uninhabitability on their terms.

### 1. Introduction

In this paper we address some of the key problems that arise in climate change research and policy development, namely the elision of the knowledges, viewpoints and ontologies of those who it appears may be the most affected. We focus on the issue of habitability of place and the links made between possible uninhabitability and the need for inhabitants to relocate or migrate. We argue that habitability is a contested concept that is strongly socially and culturally constructed and includes non-material as well as material aspects. Understanding habitability as only a material phenomenon runs the risks of policy development that disempowers affected communities who have wider notions of what makes their place acceptable to live in. Discussion and policy development in relation to forced or induced climate mobility, is, like climate change impacts and adaptation more generally, dominated by western science and legal perspectives, and often neglects to account for the concerns, customs and knowledges of the very subjects of the discourse. In this analysis we look at atoll uninhabitability as a particular trope that has not yet been extensively examined for its cultural and

social specificities.

Atolls are coral reefs, upon which low-lying islands made of coral debris form, that surround a lagoon. The risk of atoll uninhabitability in the context of sea level rise is a well-known issue, although the scientific evidence is not conclusive (IPCC AR6 WG2, 2022). Less recognised is that the concept of ‘habitability’ is culturally and socially experienced and open to multiple truth claims, shaped in part by the discourse of uninhabitability itself. Often regarded as a self-explanatory and indeed inevitable existential threat, the risks of sea level rise for atoll populations are contested, complex, dispersed in space and time, involve additional climatic and social factors, and are unlikely to take the form of a discrete submersion event (Horton et al., 2021; Duvat et al., 2021; Esteban et al., 2019). While an existential threat to an atoll is not necessarily the same as an existential threat to its population, in many Pacific Island cultures, a threat to land is experienced as a threat to culture and identity, since these are so closely intertwined (Campbell, 2019). Loss of land to sea level rise, among Pacific Island atoll populations who have contributed little to greenhouse gas emissions, is a clear climate injustice impacting more than livelihoods, health and

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<https://doi.org/10.1016/j.envsci.2022.10.001>

Received 27 February 2022; Received in revised form 4 August 2022; Accepted 1 October 2022

Available online 26 October 2022

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assets, but also cultural practices, ancestral connections, spirituality, and many other aspects of cultural and social life in coastal areas (Vaai, 2019; Kitara, 2019).

The existential threat discourse circulates widely, often for raising awareness of the climate change challenges facing atoll populations (Farbotko, 2019). However, the discourse can also have negative implications, such as declining investment by donors in atoll development and in-situ adaptation, which are atoll government national priorities (Bordner et al., 2020). Indeed, there is a possibility that the uninhabitability trope enables funding agencies and donors to promote relocation over more financially costly in-situ adaptation measures (Farbotko et al., 2020). There is very little inclusive, transparent debate involving atoll populations on how international adaptation finance decision-making considers the overall social and cultural, as well as financial, costs and benefits of movement away from atolls against the costs and benefits of in-situ adaptation, such as large-scale land reclamation. Such issues are easily overlooked when powerful, populist imagery of the disappearing islands is evoked (Barnett, 2005).

Our work neither sees island uninhabitability as inevitable, or that climate change impacts are overstated. Instead, we recognise the relational, dynamic nature of both the materiality of atoll territory and discourse relating to atolls. We use the term ‘relational’ after Vaai (2019, 7) who states that ‘[i]n the eco-relational worldview, there is no clear separation between what we normally call the ‘physical’ and the ‘spiritual’. Life is holistic’. In this relational ontology all things are connected and form a whole. If one of the elements is disturbed, the whole is disturbed. Our concern in this paper is how habitability itself can be negotiated and contested within such relational worldviews in the cultures which have long thrived on them. We will propose that placing atoll populations at the centre of habitability knowledge and decision-making is critical.

Habitability and uninhabitability can be usefully approached, more specifically, not as self-evident phenomena, or a solely technical undertaking for experts, but as emergent and contested ideas, that are inherently situated and often based on legitimate local and traditional knowledges. Scientific definitions of habitability exist (Duvat et al., 2021) but it is also important to recognise the ways in which the existential threat discourse is normalised, partly through the practices of science itself, as authority is claimed over the concepts of habitability and uninhabitability in different ways (Horton et al., 2021). Recent work in social science underscores a need to critique and examine alternatives to the discourse of existential threat, in order to acknowledge and help advance human security among atoll people (Farbotko, 2019; Bordner et al., 2020). Our aim is to make a case for greater understanding of uninhabitability as a contested signifier, which involves power relations that shape who can and should define habitability in particular places. Such an approach, we argue, can open up radical new ways in which the human security of atoll people can be both understood and advanced in the context of extreme climate risk. Taking seriously the many calls to include the voices of affected populations in knowledge production about climate change risk (eg. Arnall et al., 2019), we will argue that those who currently inhabit atolls must be central to defining habitability and uninhabitability, which will assist in recentring decision-making with affected populations about if, when, and how to respond to the changing habitability of their territory, either through movement elsewhere or not. Furthermore, exercising the power to name and claim the changing nature of atoll habitability on their terms is likely to help atoll people adapt senses of place and identity in ways that are empowering for security of being, as well as ensuring material security.

We use a transdisciplinary methodology that draws on indigenous ontologies, critical social science studies of climate mobilities, atoll discourses, and relational security in a changing climate, as well as geographic and geomorphological studies of atolls and their populations. We examine how use of the term ‘habitability’, in attempts to advance the human security of atoll people, must go beyond

consideration of the materiality of atoll life by examining tensions between local and external knowledges of (un)inhabitability. This enables exploration of new ways that atoll populations may be empowered in addressing climate risk, without an artificial separation of the ‘science’ from the ‘discourse’ of existential threat. This helps us unpack how the dominant existential threat discourse can disable possibilities for more empowering and just in-situ adaptation and mobility planning, which we argue needs to be addressed through the centralisation of atoll people’s experience and knowledge of their changing territories.

Our paper proceeds as follows. First, we examine various perspectives on atolls as precarious places to live, some of which pre-date climate change risk and are dominated by (Western) science. Then, we discuss the current state of knowledges on atoll habitability and uninhabitability, showing their contested and inconclusive nature. Next, we argue for climate-exposed atoll populations to have their experience and knowledge of habitability - and their perceived thresholds of uninhabitability - made central to science, law, policy and planning on sea level rise risk. We also discuss how security among climate-exposed atoll populations may be advanced through the process of articulating and institutionalizing both habitability and uninhabitability on their terms. We finish with a methodological reflection.

## 2. Contested discourse of atolls as precarious or sustainable places to live

*The object of the exercise of ‘sustainable development’ is to survive on the atolls forever... sustainability is the idea that we can survive from day to day, and ever after.<sup>1</sup>*

After more than thirty years of a crisis narrative for atolls about sea level rise (Lewis, 1989; Roy and Connell, 1991), atoll people are well aware of the climate change risks to their territories (Corcoran, 2016; Falefou, 2017; Talia, 2021). In the Pacific Island atoll states of Kiribati, Tuvalu and the Marshall Islands, climate change alone has not triggered atoll populations to wish to move internationally en masse. Atoll governments are largely committed to addressing climate change impacts through in-situ adaptation measures, with relocation and migration included as strategies of last resort (Bordner et al., 2020; Hermann and Kempf, 2019; Farbotko and McMichael, 2019; Oakes, 2019). These policy goals and population preferences do not per se indicate that the climate change impacts on atolls are over-stated, but are suggestive that many people want to stay in their atoll homes as long as possible. Such a trend is not surprising, as atoll societies have achieved survival through significant environmental, social and political change in the past, and have developed strong place attachments centred on *\*banua* – a proto Austronesian term most simply conceived as an island place and its community (Chave-Dartoen, 2014; Suliman et al., 2019; Campbell, 2019; Stratford et al., 2013). Current terms encapsulating this meaning include *fenua*, *fanua*, *fonua*, *whenua* and *honua* in Polynesia and *vanua* in Fiji and in parts of Vanuatu, and they often also refer to placenta which is typically buried in the land after birth to which people are returned after death. Elsewhere in the region other non-cognate terms are used but the notion of umbilical cord and unity of people and land are still vitally important (Jarillo and Barnett, 2022). While it is important not to present a view of homogeneity in the relationship between people and their land, and there are variations, the key message is that land and people are considered to be an essential unity. In *\*banua*, the people, their land and their environment are considered a wholistic system, so intricately connected as to be one entity. Since the Pacific atolls were formed around 3–4000 years ago, with human settlement no more than

<sup>1</sup> Ieremia Tabai, former President of Kiribati and Secretary-General of the Forum Secretariat New Zealand Herald, January 13, 2004, New Zealand Herald <https://www.nzherald.co.nz/world/the-fight-against-the-rising-tide/5CWHNIEFNWGX2X45ZOCWLB26DUQ/>.

2000 years ago (Kirch, 2017; Weisler, 2001a), there have been earlier periods with considerable climatic change including a warm period from 750 to 1250, a disruptive transition and then the Little Ice Age (1350–1800). These interrupted livelihoods but did not extinguish atoll societies (Nunn, 2007). Thus, populations appear to have been sustained on many atolls since original settlement, as people adapted to their dynamic atoll environment (Thomas, 2019) which included some mobility between atolls that occurred as part of this adaptation (Weisler, 2001b).

Despite this history, atolls – as with small islands more generally – have, since Western science turned their attention to them, been considered as sites of vulnerability, and hence precarious habitability, based on their smallness and isolation. These are characteristics that are perceived to place them at risk to threats including invasions, extreme weather and lack of resources (Royle, 2001). For example, Ellen Churchill Semple, an influential geographer in the early Twentieth Century, wrote:

“A small cup soon overflows. Islands may not keep; they are forced to give, live by giving. ... But finally more often than not, the limitation of too small a home area steps in to arrest the national development, which then fades and decays.” (Semple, 1911: 416)

The trope of atoll vulnerability specifically has long been influential. William Thomas (1963, 36) wrote:

“An atoll is not much of a resource base for an elaborate material culture... Human habitation of Pacific Atolls faces a somewhat uncertain and perhaps gloomy short-term future (Wiens, 1962, 135). Periods of rising sea levels in the next five to six thousand years may drown and possibly destroy most of the islets of the present reefs. ... a thousand years from now most atoll islets will be awash or largely covered by brackish or salt water swamps.”

Thomas and Wiens, writing before the emergence of the narrative of sea level rise risk associated with anthropogenic climate change, reinforce Semple’s theorising of the inherent precarity of everyday human life on islands, a view which, importantly, is not shared within atoll societies (climate risk aside). Yet the tendency of Western science to commence from an understanding of atolls as ‘precarious’ and ‘on the edge’ (Weisler, 2001a, 2001b) persists, contrasting with the continuation of everyday life on atolls, with people living in a sustainable way with their plentiful marine and avian resource environments, including through more recent external shocks such as colonisation and war (Fitzpatrick et al., 2016; Thomas, 2019; Weisler, 2001a). Atoll people indeed perceive their environments as a source of food security, accessing coconuts and fish from the land and sea, resources which are highly valued, particularly in times of crisis (Farbotko, 2021).

The vision of islands as inherently vulnerable, precarious places to live has been extensively critiqued in island studies scholarship (eg. Kelman, 2020) and human geography (eg. Barnett and Waters, 2016) as well as on decolonial grounds by Indigenous scholars (eg. Hau’ofa, 1993, 1994; Teaiwa, 2019). The notion of vulnerability is problematic because it relies on categorising internal characteristics of phenomena (things, people, islands) at risk to an external threat. This may lead to only a narrow range of perceived solutions. Rather than changing the threat, the vulnerable are imagined to need to increase their material resilience, or if unfixable, leave the site of their vulnerability, potentially resulting in ‘blaming the victims’, particularly if they are seen as unwelcome or threatening when moving to a new area (Barnett and Campbell, 2010). The notion of island vulnerability has received new impetus with the onset of climate change science, with low-lying and other small islands identified in the United Nations Framework Convention on Climate Change (UNFCCC) as being particularly vulnerable. The island vulnerability discourse has also been appropriated by political leaders and activists representing small island states in international climate change negotiations to stress the need for urgency in greenhouse gas reductions, with limited success.

For their inhabitants, the ongoing sustainability of atolls has cultural and cosmological elements as well as environmental (Falefou, 2017; Talia, 2021). Cosmologically, land is a cornerstone of atoll societies, so relations to land are significant in how life – and habitability and uninhabitability – are experienced and conceptualised. In Kiribati, for example Herman and Kempf (2019) describe how land (*aba*) is inextricably tied into I-Kiribati conceptions of their future. The idea that the land may cease to exist due to sea level rise is therefore untenable. For many I-Kiribati, remaining on the land (which may include customary lands, home islands or the nation as a whole) is a cosmological and cultural necessity such that in situ adaptation to climate change is critical. Hermann and Kempf also describe a discourse of hope and trust in God as underpinning the desire of some to stay in Kiribati in the face of climate change risk. The connection to land for some is so strong that it is preferable to stay beyond the threshold of habitability.

Yet, the desire to stay is not a universal response. Both staying put and moving have been part of national policy and public debate in Kiribati over the past two decades, with different emphases under different leaders (Hermann and Kempf, 2019). The government of Anote Tong (2003–2016) promoted adaptation and lobbied for international reductions in greenhouse gases, also promoting a policy of ‘migration with dignity’. Under this policy, overseas employment could lead to either permanent residency in a new country, or returning to Kiribati with skills and remittances to contribute to resilience in the homeland. The purchase of a large block of land on Vanua Levu, in Fiji, was also seen as providing a possible destination for climate change migrants though the government claimed its main purpose was an economic investment. The next national government in Kiribati, led by Taneti Maamau, which entered office in 2016, focused heavily on staying in place, reducing focus on migration with dignity, although continuing to support temporary international labour migration, which has long been important to the Kiribati economy. Both governments oversaw significant in-situ adaptation efforts including large areas of land reclamation on South Tarawa, the capital and very densely populated urban centre. In addition, the World Bank funded Kiribati Adaptation Programme (KAP) (2003–2016) provided protection of a number of coastal areas through engineered works and mangrove planting and improved water management.

Corcoran (2016), an I-Kiribati researcher, conducted extensive data collection with I-Kiribati people to elucidate their views on climate change challenges. One of his participants on Betio explained:

Our major concern now is about losing our islands to the rise in sea level, our Kiribati culture dictates that our land is our identity, if we have no land we have no culture and we are not a people anymore ... so it is important to work together to ensure our islands survive the future impact of the rise in sea level. (Quoted in Corcoran, 2016, p231)

On the larger island of Kiritimati another participant expressed that “... we have to work together to protect our islands ... I have faith in God that he will look after our islands ...” (Quoted in Corcoran, 2016, p232). Not all of Corcoran’s participants were so hopeful as stated by a man on South Tarawa:

I will not leave my island...if the rise in sea level is going to destroy my island in the future I will stay and die like a man on the land I was born [and] raised on ... this is the land of my ancestors. (Quoted in Corcoran, 2016, p232).

Although each of these participants had a contrasting attitude toward the future, all were committed to the idea of staying in Kiribati.

Falefou (2017), a Tuvaluan researcher, found similar sentiments expressed in Tuvalu where many participants indicated they would stay on their islands until the end. But not everyone held such views. One of his participants on Nanumea disagreed with the group consensus that people did not wish to relocate:

I think if scientists' prediction is true, then I think I would go [sigh] so I could survive...I do not want to prematurely die of stubbornness just because of my heart for my island sinking and to be drowned together with it. (Quoted in [Falefou, 2017](#), p. 2g86)

Thus, apart from a few who perceive relocation or migration as feasible, a dominant view in Kiribati and Tuvalu is that, should the islands become uninhabitable, this would be very undesirable, and difficult or even impossible to countenance cosmologically or spiritually ([Kitara, 2019](#)). Such responses to climate risk on atolls are being conceptualised using terms such as climate immobility, that help to capture the desires of many atoll people to continue to enjoy the right to stay on their island homes, in perpetuity (e.g. [Farbotko and McMichael, 2019](#); [Jarillo and Barnett, 2022](#); [Farbotko et al., 2020](#); [Rudiak-Gould, 2009](#); [Hermann and Kempf, 2019](#)).

Yet inhabitants' preferences for climate immobilities are hardly working to unsettle the existential threat discourse that persists among many (external) researchers, planners, climate activists and the public: that atoll dwellers will be among the first 'climate change refugees' ([Farbotko and Lazrus, 2012](#)). This persistence of the existential threat discourse has real effects for atoll people. As [Bordner et al. \(2020\)](#) show, false assumptions about inevitable uninhabitability among external donors are already reducing aid flows to the Marshall Islands. Further, greater political commitment at the level of UNFCCC could result in workable, if expensive, in-situ adaptation options that enable people to exercise their right to stay in their ancestral *\*banua*. For example, the Kiribati government developed the Temaiku Land and Urban Development project plan, involving 300 ha of reclaimed land resilient to predicted 2200 ocean levels, with space for 35,000 people to live ([Jacobs, 2020](#)). The award-winning project is, to our knowledge, not yet gone ahead. It serves however, as a clear vision of a habitable future for Kiribati, albeit a complex one in which issues such as land ownership in reclaimed areas, as well as a lack of cultural attachment to new land areas, and local environmental impacts, arise as potentially new issues to be resolved ([Barnett et al. 2022](#); [Kitara, 2019](#)).

Our discussion of atolls, and Kiribati in particular, shows how habitability is apprehended and experienced, situated in specific cultural contexts. When faced with the prospect of one's homeland becoming uninhabitable, responses can be quite different for different people, within the same environmental conditions. Some people have no intention of leaving, while cognisant of the risks and personal experience of climate change impacts, and others prefer to move away, and this is underscored at least in part by different ways in which people situate themselves in climate-impacted places culturally, socially and politically as well as materially. For atoll societies, any consideration of a possible trajectory from habitable to uninhabitable must include recognition that atoll people are not static inhabitants of their small and isolated island domains ([Bridges and McClatchey, 2009](#)). Local lives on atolls change as people deal with changing environmental conditions, meaning that small-scale, material adaptations to place that enable people to continue to live in newly flood-prone areas are important considerations ([Esteban et al., 2019](#)). So too is the fact that Pacific Island people, including atoll societies, have long histories of migration dating back millennia to their arrival in distant islands across the vast Ocean. Curtailed somewhat by the Little Ice Age ([Nunn, 2007](#)), this mobility continued into the colonial era although new boundaries restricted some journeys ([Hau'ofa, 1993](#)). There are sizeable diaspora of atoll people having existing migration access to Aoteroa New Zealand and the United States (see [Table 1](#)). There have also been relatively high proportions of atoll populations who engage in circular forms of mobility through their work in international industries such as phosphate mining and commercial shipping. Migration policies, including the Pacific Access Category, and provision for seasonal agricultural workers, have seen the growth of I-Kiribati and Tuvaluan people in Aoteroa. In addition, all three atoll states have very high levels of internal migration with large proportions of their populations living in urban areas. It is unlikely that

**Table 1**  
Populations of Atoll PICTs and their diaspora.

PICT	Population					
	Domestic <sup>a</sup>		In Aotearoa/ NZ <sup>b</sup>		In USA <sup>c</sup>	
	2020	Per cent Urban <sup>a</sup>	2018	2006	2018	2010
Kiribati	118,414	57	3225	1116		
Marshall Islands	53,167	74			30,000	22,343
Tokelau	1319	0	8676	6822		
Tuvalu	11,287	63	4553	2625		

<sup>a</sup> Secretariat of the Pacific Community (SPC) (2021).

<sup>b</sup> <https://www.stats.govt.nz/tools/2018-census-ethnic-group-summaries>.

<sup>c</sup> [van der Geest et al. \(2019\)](#).

most of these migrants were singularly induced by climate change, and some of the migration predates climate change discourses. However, the numbers indicate the high mobility of some atoll dwellers where opportunities exist.

Atoll populations in the Pacific are thus highly mobile, often across international borders, even while maintaining extremely strong attachments to their *\*banua* ([Stratford et al., 2013](#); [Suliman et al., 2019](#)). As highly communal societies, with extensive kinship obligations, the mobilities of atoll people are not solely concerned with individual or household-level decision-making but also with wider family relations. For those who prefer immobility in the face of sea level rise risk, this rather ironically makes it easier for extended family members to migrate, knowing their *\*banua* remains complete with human and non-human components together in place. On the other hand, those who migrate are also relinquishing, at least while they are abroad, their share of valued, collectively owned land and its resources for the benefit of other family members. The use of the term 'climate (im)mobility', with parentheses, perhaps best describes the situation in which some members of a society remain in place, exercising their right to stay as well as their obligation to maintain *\*banua*, while others migrate and provide different forms of support to the *\*banua* from abroad. The impacts of sea level rise, or expectations about its future impacts, therefore may lead to increasing numbers of migrants, but alongside a significant number of immobile people, who choose to stay on in their ancestral home. The term climate (im)mobility allows for both possibilities: migration for those who choose, or even want, to leave their *\*banua* and the right to stay for those who do not wish to be mobile. Individuals may through their lives move from mobility to immobility and migrants may return home to stay for their later years. Taking these relational (im)mobilities into account, it is clear that there is no simple causal relationship between declining habitability and population movement.

Of interest here is the atoll population of the Carteret Islands (a subnational atoll within Papua New Guinea) where land loss, inundation events, salination of the Ghyben–Herzberg lens with associated degradation of swamp taro gardens and water supply have been causing coastal habitability challenges since the 1960s ([O'Collins, 1990](#)). Here, tectonic subsidence of the atoll has hastened the effects of sea level rise, uninhabitability is experienced as a daily part of life. There has been a locally organised programme, Tulele Peisa, to locate land for relocation on the large Bougainville Island (60 km away), also part of Papua New Guinea ([Rakova, 2014](#)). Some older residents wish to stay but the search for relocation options has considerable urgency. Indeed, people from the Carteret Islands have repeatedly sought to establish settlements on Bougainville with limited success since the 1980s, and remain engaged in the task of finding a relocation solution, finding that habitability in a new place, due to social and cultural challenges, is difficult. It is not anticipated that relocation will be absolute, as significant numbers plan to stay in their 'uninhabitable' ancestral lands, and there are plans to have a regular sea transport service between the island and the mainland ([Boege and Rakova, 2019](#)). This example shows that habitability and

uninhabitability are relational, unfold as processes over time, are experienced differently by different people, and are shaped by human as well as environmental characteristics of multiple places.

### 3. Critiquing ‘habitability’

Our discussion has indicated the contested discourse on the precarity of life on atolls, which has become complexified with the onset of debates about climate (im)mobilities, which we exemplified with vignettes. There is a range of perspectives on the relation between habitability and uninhabitability that underscores the existential threat discourse. It is problematic that little attention has been paid to critically analysing the concept of habitability, and how it is applied in various narratives of the future. The ‘stay here and die’ perspective discussed above, for instance, is strongly suggestive of unique conceptualisations of habitability in Kiribati and Tuvalu, in which land is a cosmological cornerstone as well as a resource for livelihoods. The emergent picture of uninhabitability and habitability becomes one of signifiers: the qualities that make a particular place possible to live in – or not – are both material and culturally and historically specific, involving local knowledges, cosmologies and place attachment.

To continue our exploration of the concept of habitability and its contestation, here we examine the science of sea level rise risk, to show how habitability is open to multiple truth claims within a particular body of knowledge. Some research aligns closely with visions of atolls as precarious places with a bleak, likely uninhabitable future as a result of sea level rise, and others posit more positive scenarios without the need for relocation. [Storlazzi et al. \(2018\)](#), for example, state that most atolls will be uninhabitable by mid-twenty first century because of increased over wash that will damage infrastructure and degrade freshwater lenses on a yearly basis. This view is supported by several researchers working in the Pacific region who conclude that many low islands and coastal lands on high islands will become unable to support their populations, exemplified by [Nunn and McNamara \(2019, p20\)](#) who state that “[f]or some small islands, the reality is that in the next ten to twenty years, coastlines will become uninhabitable.”

Counter to this perspective is geomorphological research suggesting atoll islands may maintain their existing land areas, and in some cases even grow in areal extent and elevation, as sea levels rise. [McLean and Kench \(2015\)](#) examined historic planform changes on over 200 atoll islands on 12 atolls in six different Pacific Island countries under conditions of sea level rise, particularly over recent decades. They found that rather than losing large areas of land from erosion and inundation, most atolls grew in size both vertically and horizontally. The main mechanism was the deposition of coral rubble or sand by waves, including those generated by tropical cyclones that over washed entire islands. They suggest that scenarios of atoll disappearance are overly pessimistic, and that relocating people within atoll countries from islands that are eroding to those which are more robust would be an appropriate adaptation response rather than international migration to non-atoll states.

[Kench et al. \(2018\)](#) followed up with a detailed analysis of atoll morphology in Tuvalu. They found that between 1971 and 2014, a period when sea-level rise in the central Pacific was several times greater than the global average, most of Tuvalu (74 per cent) increased in land area. Only one atoll, Nanumea, experienced net erosion. Moreover, they found that larger islands, located on the windward sides of atolls, were more stable and likely to increase in land area than smaller ones, often located on the leeward sides of the atolls. The former comprise mostly gravels and the latter, sand. They observed:

‘... while we recognise habitability rests on an additional set of factors loss of land is unlikely to be a factor in forcing depopulation of islands or the entire nation. However, changes in land resources may still stress population sustainability in the absence of appropriate adaptive initiatives’ ([Kench et al., 2018](#)).

This study also suggested that international migration would be unlikely to be necessary as migration to the larger atoll islands within Tuvalu would be possible.

Interestingly the Intergovernmental Panel on Climate Change WG2 does not define habitability or its antonym in Assessment Report 5, and the Small Islands chapter ([Nurse et al., 2014](#)) uses the term only once: to refer to the fact that the First Assessment Report observed that some islands would be rendered uninhabitable if sea level rose by one metre before 2100. However, habitability is defined in the Glossary of the IPCC special report on Cryosphere and Oceans, although there are relatively few references and the term uninhabitable is not used. The report defines habitability in material terms in its glossary:

Habitability: The ability of a place to support human life by providing protection from hazards which challenge human survival, and by assuring adequate space, food and freshwater ([IPCC, 2019, p688](#)).

The same definition is used in AR6 and the chapter on Small Islands uses the term and its associates (inhabitable and uninhabitable, etc.) 30 times. This reflects the change in vulnerability discourses relating to small islands and particularly atolls from ‘sinking’ or ‘disappearing’ - which have become difficult to justify - to one of uninhabitability. Both discourses, however, privilege migration over in situ adaptation. While efforts have been made to clarify the material components of habitability (see below) its relational elements have not been addressed. To our knowledge, the notion of habitability in the context of climate change has been subject to little critique or interrogation.

Importantly, the science discourse on atoll habitability is shifting from a simplistic view of disappearing land, to one of multiple forms of environmental degradation, although like the idea of climate immobility identified above, this is having little impact on the persistent existential threat discourse. For example, the IPCC AR5 chapter on islands is agnostic about atoll vulnerability and refers to several papers suggesting atoll islands will not decrease in size ([Nurse et al., 2014](#)). In comparison the earlier first assessment report (FAR) in its chapter on ‘Oceans and Coasts,’ while acknowledging some uncertainty, painted a much less positive future for atolls. The second assessment report, while saying atolls are particularly vulnerable, noted a number of studies that suggest atoll dynamics are much more complex than previously thought. It is likely that the early findings (FAR) were picked up by atoll governments, environmentalists, some researchers and the media, shaping the existential threat discourse.<sup>2</sup>

As noted above, habitability is, usefully, becoming more carefully elucidated in recent scientific studies. [Horton et al. \(2021\)](#) define habitability as the environmental conditions in a particular setting that support healthy human life, productive livelihoods, and sustainable intergenerational development, and identify a clear need for ‘bottom-up’ knowledge of habitability. [Stege \(2018\)](#), a Marshallese researcher and community leader, sets out to examine ‘atoll habitability thresholds’ in which he incorporates ‘internationally recognised standards of flood risk management’ with local and traditional knowledges of atoll communities in RMI. The approach placed emphasis ‘... on opportunities to engage atoll communities and incorporate indigenous knowledge into the flood risk modelling methodology by way of the Reimaanlok framework [RMI national planning framework based on local input]’ (p20). By combining both local environmental and cultural knowledges with those of external knowledge producers, it was possible to identify points beyond which in situ adaptation may become untenable. Without the inputs of both sets of expertise, such conclusions could not be successfully drawn, although we note that the combination of two

<sup>2</sup> The UNFCCC has much stronger statements about small islands but doesn’t mention atolls specifically, rather drawing attention to the ‘particular’ vulnerability of ‘low-lying and other small island countries’ among other vulnerable nations.

different knowledge systems is not simply about juxtaposition or validation. Indeed, there are strong arguments that Indigenous knowledge systems should form the basis of self-determined, just solutions, with relevant scientific knowledge brought in for support where needed (Mistry and Berardi, 2016). Duvat et al. (2021) expand the IPCC definition of habitability to include economic opportunity, introducing five habitability pillars (HPs) (Table 2).

Duvat et al. (2021) evaluated the effects of climate stressors on each of these HPs for two climate change scenarios used by the IPCC (RCPs 2.6 and 8.5) and for two different time horizons (2050 and 2090). They found that each of the HPs would be exposed to additional risks and that when taken cumulatively the habitability of atoll islands in the future is likely to be threatened. This analysis does not appear, however, to consider actions to offset some of the impacts on HPs.<sup>3</sup> They note that the effects on habitability will vary among islands, which is an acknowledgement of the importance of specific contexts and conclude that further research is needed to better understand the multiple, inter-related effects of climate change on atoll habitability.

Returning to Kench et al.'s study, which suggested that atolls will withstand increasing rates of sea-level rise, their question of "additional factors" that might render atolls uninhabitable is significant. But so too is the possibility that habitability itself is not as at risk as the existential threat discourse suggests. Agreeing with Duvat et al.'s recommendations, further research is needed, but not only on the material effects of sea level rise and other climate change impacts. Scientific approaches to habitability tend to exclude the non-material, relational and culturally and socially specific elements of habitability which are observable in everyday practices and cultural life in atolls, and captured in local knowledge and belief systems. Built into future research should be acknowledgement of a greater range of possibilities in defining, and planning for the trajectory from habitable to (possibly) uninhabitable, taking specificities of the atoll society into account. To the science of habitability, a transdisciplinary understanding of the existential threat discourse is needed, which would enable a move beyond the reproduction of uninhabitability as (almost) a *fait accompli*. The concept of

uninhabitability needs contextualising and to be analysed for its usage, given its role in starting to create the conditions it names through material practices such as reduced investment (Bordner et al., 2020). Being forced to leave one's *\*banua* can have impacts that go well beyond the material. This, we argue in the next section, also needs to be captured in habitability research, using the concept of relational security.

#### 4. Habitability and relational security

Currently, as scientific actors claim a stake in defining habitability, with likely flow-on effects for areas such as planning, investment and security, there are potentially significant implications for the inhabitants of particular places at risk from sea level rise. Since, as we have explored, habitability has both material and non-material elements, and has different characteristics over time in different contexts, uninhabitability is not just the absence of material conditions of habitability as currently defined in science. If, hypothetically, habitability were to remain understood as only material in nature, and become formalised and legitimised according to this type of definition (eg. In published peer-reviewed science, adopted in policy), affected populations would have far fewer opportunities to contest, from differing cultural perspectives, what may come to be accepted as the 'correct principles' of habitability. Further, uninhabitability may come into being as a policy category *by default* if and when the material conditions of habitability are not met. In response to such concerns, we suggest an expanded approach to habitability, including but also going beyond the material, is needed. We start with the notion of ontological security, meaning security of being as theorised by Laing (1960) and Giddens (1991), which is becoming increasingly recognised as useful to holistically capture material and non-material elements of human security among atoll people facing a possible future of uninhabitability (Campbell, 2019; Farbotko, 2019; Mattos and Henao, 2021). Campbell (2019) conceptualised ontological security in terms of the interlinkages between material, social and cultural security, with land as the cornerstone (Table 3).

Within Campbell's (2019) model, ontological security is likely to be significantly impacted if land does become uninhabitable, for both those who choose to stay and those who go. It is possible, however, to add a political element to this model of ontological security, acknowledging the radical potential of atoll people building new forms of belonging and identity in a changing world (Kofe, 2021). Specifically, if those who live on atolls have the power to name and claim the unfolding and as yet unfinished history of sea level rise and other climate change impacts in their atoll homes, their political agency vis a vis the existential threat discourse is likely to be advanced. Further, leading processes of identifying and centralising atoll-centric perspectives on habitability and uninhabitability may give rise to new, adapted forms of belonging and identity among atoll people, and hence advance their ontological security. Power over one's society's future is possible even in the case of an existential threat to ancestral homelands, and this may very well occur in ways that outsiders currently do not countenance. For example, staying on in places that are difficult to live in from a material point of view, but enable the continuance of cultural practices and cosmologies, can build ontological security (Farbotko, 2019). Similarly, cultural and political practices, that maintain connections to homelands materially or cosmologically, as in the case of Banabans displaced to the island of Rabi in Fiji, may also build ontological security (Teaiwa, 2005). In practical terms, these ideas mean that climate-exposed atoll people must

**Table 2**  
Habitability Pillars defined by Duvat et al. (2021).

Habitability Pillars (HP)
(1) availability of sufficient and safe land ("Land")
(2) supply of safe freshwater, especially from local sources ("Freshwater supply")
(4) access to safe settlements and infrastructure that sustains freedoms and opportunities, such as for trade, healthcare and education ("Settlements and infrastructure")
(5) access to sustainable economic activities ("Economic activities")

<sup>3</sup> For example, freshwater supply issues could be resolved through desalination and food could be imported. Desalination has potential to provide water for atolls such as in the Maldives where the capital Male' with a current population of 130,000 has been dependent upon desalinated water for decades, especially during its annual dry season. Mobile and permanent small desalination systems are already used following cyclones and during droughts in several Pacific atolls. However, such solutions are not without problems, a major one of which is the management of large amounts of a heavily concentrated brine by-product, the disposal of which has serious environmental impacts (Jones et al., 2019), in addition to the energy costs of desalination and GHG emissions, although renewable systems may offset some of these concerns (Abdelkareem et al., 2018). With respect to food, care would be necessary to ensure access to both culturally appropriate and healthy supplies. Already many Pacific Island societies, including those on atolls, are heavily dependent upon imported foods such as canned meat and fish, mutton flaps, turkey tails, rice and instant noodles which have replaced fish and local crops, and many of which have low health benefits, at least from a western medical perspective (Connell, 2019; Errington et al., 2013; Singer, 2014).

**Table 3**  
Ontological security defined by Campbell (2019).

Elements of Ontological Security
Material: space, soil, plants, animals, subsistence and cash livelihoods, health, safety
Social: community, kinship, leadership, reciprocity
Cultural: place, identity, birth, death, belonging, stewardship, past, future

lead (not in a peripheral way or as a ‘participatory’ add-on to science and/or policy) processes of articulating and institutionalizing what both habitability and uninhabitability means, to them, on their terms.

Thus far, we have used ontological security in a rather basic way to describe the confidence in everyday social, environmental and spiritual conditions being such that individuals can reasonably expect to cope on a day-to-day basis. In this sense it is the security of being. This diverges significantly from the usage of Laing (1960) who coined the term in relation to people with psychological pathologies who struggled to move beyond ontological insecurity. The term was picked up and used quite differently thirty years later by Giddens (1991) to describe a social condition in which individuals felt secure in the everyday continuity of their existence. In this study, a more expansive concept is needed that recognises the confidence that people have in their relational being including their personal safety, the environment that both provides material support and of which they are part, the social group of to which they belong, and the spiritual milieu which encapsulates all of these elements. While reflecting the idea of security of being, this seems to go beyond the ontological security of Laing and Giddens which was developed in a western context and focussed on individual security. The inclusive/relational notion of *\*banua* was not part of the ontology of ontological security. Ontological security, the security of one’s existence, in the Pacific, may not be possible without the *\*banua* (in its broadest meaning) and one’s relations within it. The importance of kinship and communal relationships in the Pacific is at odds with the individual aspects of ontological security as developed by both Laing and Giddens, although we recognise that while the collective is important in the Pacific, so too is the individual. This is noted by Ravuvu (1988, 7) in his description of *vanua* in a village in Fiji:

The people of Nakorosule cannot live without their physical embodiment in terms of their land, upon which survival of individuals and groups depends. ... Land in this sense is thus an extension of the self; and conversely the people are an extension of the land (Ravuvu, 1988: 7, emphasis added).

Accordingly, while the idea of an individual’s security of being is very important, it is strongly linked to the group, to the land (and associated terrestrial, biological, atmospheric, and marine ecosystems) and to the spiritual world. It is here that we consider Pasifika ontological security diverges from that in the western world. Given that relationality is a critically important part of Pacific life, we suggest the term relational security may help distinguish the Pacific security of being from the western and individualistic characteristics of ontological security. Authentically centring atoll peoples’ meanings of habitability and uninhabitability can ensure that science, law, policy and planning are engaged in advancing relational security, rather than potentially placing it at even greater risk, through naïve reproduction of the existential threat discourse and neglect of cultural and cosmological aspects of habitability. Engaging with their own meaning of habitability may, for example, build new forms of social and cultural resilience that see relocation emerge, in the opinion of some atoll people, as a more desirable outcome than is currently the case, particularly if atoll people develop their own strategies for maintaining their identity, culture and relational security in a new place (Kitara et al. 2021).

Keeping the concept of ‘uninhabitability’ open to transparent, rigorous debate, led by the affected people themselves is important for relational security and indeed climate justice for atoll people. Centralising affected people in defining their thresholds of habitability and uninhabitability may lead to greater involvement in, and a sense of

ownership over, all aspects of planning that address sea level rise and other climate change risks.<sup>4</sup> Such an approach would reduce the risks of forced relocations, which are unjust (Tabe, 2019), and can be as damaging to relational security, as material losses and risks in places where sea level rise and other climate change impacts are being felt (Farbotko, 2019). Just as relocation in the context of development often favours the interests of the powerful over the vulnerable (eg. Rogers and Wilmsen, 2020), relocation in the name of climate change can become a form of exerting power over vulnerable people, under the guise of protecting their human security (Wilmsen and Rogers, 2019). When a state decides that relocation of villages away from coastal areas is necessary, for instance, there is coercive power involved if there is no option for people to choose not to relocate. Relocation programmes, once started, take on powerful momentum. While affected people might, through consultations and ‘participatory processes’ have some say in how the move takes place, they may very well have no say in the evaluation of the habitability of the place and whether or not the mobility itself occurs. To date countries developing relocation guidelines in the Pacific region (Fiji and Vanuatu) have stipulated that communities can only be relocated if they so wish. However, adaptation projects typically require considerable international funding, with the potential for pressure to be exerted on national governments for communities to be relocated, rather than requiring more ‘expensive’ (in the short term) *in situ* adaptation. In such situations, material versions of habitability could provide a lower threshold for habitability than habitability perceptions of the local population, thus potentially resulting in problematic forced relocations. As a corrective to these subtle and indirect forms of power exerted in the name of adaptation atoll people, as a matter of climate justice, have the right to name and claim the changing nature of the place they live.

## 5. Methodological reflections on the study of atoll habitability

Vaai (2019) makes a strong case for centring the relational and spiritual ontologies of Pacific people and placing them at the forefront of knowledge on the effects of and solutions to climate change in the region. This is particularly important in relation to the (un)inhabitability of Pacific atolls. Without centralising the ontologies of those affected, research findings are likely to be inapplicable to adaptation projects (including relocation), and thus fail due to lack of local support and knowledge. Accordingly, there is a pressing need for researchers and other practitioners to accept and work with plural ontologies, likely also decentring their own, in seeking to understand climate change impacts and appropriate adaptations (Nightingale et al., 2020; Rarai et al., 2022). Yates et al. (2017) suggest we seek to find ‘ontological conjunctures’ which enable multiple, different and contested ontologies to inform each other, which we have attempted to do in this paper.

This presents a challenge for researchers and planners with western epistemological and ontological perspectives where the focus tends to be on the knowable and the material, especially salient in climate change research, which is a classically top-down research project with a global compass. Dominating this process is scenario development, which has been a focus of IPCC activities, setting thresholds for different processes that impact upon social and biophysical systems (e.g. IPCC and SRES, 2000; IPCC AR6 WG1, 2021; IPCC AR6 WG2, 2022). While engaging social and biophysical scientists from all over the world (although mostly from OECD countries), the IPCC process is rooted in a western scientific hegemony that rejects ‘non-rational’ (read: spiritual and relational) knowledge processes. The hegemony of these processes undermines local knowledges based on observation, experiences,

<sup>4</sup> Although beyond the scope of this paper, we envisage this as going well beyond the standard trope and practice of ‘participation’ and which would require significant institutional effort (at state and international levels alike) to legitimately accord affected populations the power to define what habitability means to them.

ontological conceptions, and scientific and political discourses about climate change.<sup>5</sup>

The implications for work on adaptation, (un)inhabitability and the possibilities of (im)mobility are that, if research continues as currently practiced, the hegemonic notions of islander vulnerability, future uninhabitability of their lands and the inevitability of forced migration will continue to be reproduced, further disempowering atoll populations. Contemporary patterns of research and policy develop will need to be reassessed to ensure local ontologies are not elided.

## 6. Conclusion

In this paper, we have argued that the concepts of habitability and uninhabitability need to be recognised in research and policy as relational, situated concepts – there is not necessarily an objectively knowable point at which a place becomes uninhabitable – and thus questions must be asked about who can and should define habitability in particular places. Indeed, the process of defining habitability and uninhabitability should be recognised not only as a technical undertaking for experts, but as an inherently situated process that can only deliver climate justice when the affected population have an authentic and valid role. For the atoll populations that are the subject of an existential threat discourse associated with sea level rise risk, habitability does not involve only material elements of human security, but rather is relational to specific cultures, cosmologies and relationships to land. Western science, however helpful in identifying the material effects of sea level rise for atoll people, is limited in the extent to which it can, without the knowledge leadership of atoll people themselves, grapple with the *meanings* of habitability and uninhabitability. We conclude that climate-exposed atoll populations must be accorded the right to have their experience and knowledge of habitability – and their perceived thresholds of uninhabitability – central to science, law, policy and planning that seeks to address sea level rise risk. Moreover, relational security among climate-exposed populations may be advanced through the process of articulating and institutionalizing both habitability and uninhabitability on their terms, and this is arguably as important as the protection of material forms of security.

## Funding

Carol Farbotko acknowledges funding from Australian Research Council FT210100512

## CRediT authorship contribution statement

**Carol Farbotko:** Conceptualization, Writing – original draft. **John Campbell:** Conceptualization, Writing – review & editing.

<sup>5</sup> Recognising the importance of atoll knowledges, cultures, cosmologies, aspirations and expectations requires significant changes in research and planning practices in Pacific Island contexts, particularly finding ways for centralising knowledge practices of inhabitants whose lived experience makes them the experts of their place, if meaningful and durable outcomes are to be achieved. There are major challenges which are beyond the scope of this paper to explore in full, but which need to be flagged: researchers, government workers and other practitioners are usually under significant pressure to reduce costs, spend short periods in field work, quickly produce results (such as academic papers or planning reports) and to implement adaptation projects within short funding timeframes. These all militate against the centring of culturally meaningful understandings of environmental change, what is important to people, and local understandings of (un)inhabitability. But more is needed: for local ontologies to be placed to the forefront, so too must local knowledge holders have meaningful leadership roles in research and adaptation planning. However, it is possible, if not likely, that such individuals may have other priorities including livelihoods. Accordingly, issues relating to equitable payment also need to be addressed.

## Declaration of Competing Interest

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

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