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## Land tenure and urban climate resilience in the South Pacific

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### ABSTRACT

Urbanisation trends and global environmental change are two of the most critical modern-day stressors threatening the resilience of cities around the world. This paper focuses on Honiara, the capital city of the Solomon Islands, which is experiencing rapid urbanisation and a resultant spread of informal settlements. Similar to other primary cities in the South Pacific, the rate of urbanisation is severely testing the local government's ability to respond to growing levels of informality; and increasing the climate vulnerability of residents. Based on recent urban climate resilience and land tenure research conducted for the United Nations Human Settlements Programme (UN-Habitat) and the Global Land Tool Network (GLTN) respectively, the paper analyses land issues in two informal settlements in Honiara to highlight the inter-linkages between security of land tenure and climate vulnerability, and how insecure land tenure adversely impacts local adaptive capacity and adaptation planning. This analysis is embedded in the context of the South Pacific region, where duality tensions exist between Western-influenced land tenure arrangements within cities - a legacy of colonial times - and customary arrangements that operate in the surrounding peri-urban and provincial areas. Given the identification of strong links between security of land tenure and climate vulnerability, and the complexity of property rights in the region, the paper argues that principles of good land governance are an essential component of climate resilience thinking and actions.

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Climate change; Small island developing states; vulnerability; urban resilience; land tenure

### Introduction

Rapid urban growth and increased climate risks are adversely impacting many fast-growing cities in the developing world, leading to greater urban vulnerabilities and potential failure of the complex support systems that cities depend on (Bicknell, Dodman, & Satterthwaite, 2009; Bulkeley, 2013; Friend et al., 2014). Although less profiled than their Asian counterparts, a number of primary cities in the South Pacific region are currently experiencing acute stresses; with rapid urbanisation, unplanned growth of informal settlements, geographical isolation, infrastructure deficits, weak institutional capacity, and past and ongoing impacts of natural hazards such as floods, cyclones, etc; all combining to undermine their resilience (Gero, Meheux, & Dominey-Howes, 2011; Jones, 2017; Keen & Barbara, 2015; Kiddle, McEvoy, Mitchell, Jones, & Mecartney, 2017; Mitchell, Orcherton, Numbassa, & McEvoy, 2016; Orcherton, Mitchell, & McEvoy, 2016; Trundle & McEvoy, 2017). The future impacts of a changing climate will further amplify risks in the urban environment (PACCSAP, 2014), generating new vulnerabilities and increased marginalisation of vulnerable groups and communities, particularly those residing in informal settlements (Satterthwaite, 2013; Trundle, 2016).

As noted by UN-Habitat (2010), informal settlements tend to dominate in fast growing cities in the developing world, typically developing on illegally occupied or subdivided land that often remains vacant due to exposure to hazards such as flooding, coastal storms, landslides, etc. (Mearns & Norton, 2007; Satterthwaite, 2007; World Bank, 2012). These sites are chosen

by migrants as they are less likely to be evicted; however the ensuing environmental and institutional risk results in poor security of land tenure and often an unwillingness to invest in more protective shelter (Dodman et al., 2013; FIG, 2014; Mitchell, 2010; Mitchell, Enemark, & van der Molen, 2015). Conversely, secure land tenure can be a pivotal element of community resilience as it allows individuals to invest in their property, establish livelihoods, and access essential services (Durand-Lasserre & Selod, 2009; Mitchell et al., 2015; Reale & Handmer, 2011); as well as reducing the risk of forced eviction and land grabbing (Quan & Dyer, 2008).

This paper on land tenure and climate resilience in the South Pacific draws from research carried out in 2018, funded by the GLTN, to identify and analyse inter-linkages between land tenure and climate vulnerability for urban and rural contexts in different parts of the world; including the Caribbean, Syria, Uganda, Philippines, and Honiara, the capital city of the Solomon Islands (Mitchell & McEvoy, forthcoming). The Honiara case study builds on long-standing engagement with informal settlements through a city-wide adaptation planning process, supported by UN-Habitat, culminating in the development of the Honiara Urban Resilience and Climate Action Plan (HURCAP) (Trundle & McEvoy, 2017) and subsequent funding from the UNFCCC Adaptation Fund to scope and implement actions identified by the HURCAP (2018–2022).

It is also important to note at the outset of this paper that the GLTN 'land tenure and climate vulnerability' project was cognisant of other relevant ongoing initiatives such as the Participatory Slum Upgrading Programme (PSUP), supported by

UN-Habitat since 2008, and Solomon Islands Government efforts to ‘formalise’ settlements and housing through a more intensive process of sub-division and converting crown to leased land; though with mixed success to date (Keen & Kiddle, 2016).

The remainder of the paper focuses primarily on two informal settlements in Honiara (Kukum Fishing Village and the Aekafo-Feraladoa Informal Settlement Area) which are characterised by contrasting land tenure arrangements and climate-related risks. These case studies are used to support the authors’ contention that an improved understanding of the links between contemporary human and natural drivers, and the complexity of urban land tenure in Pacific Small Island Developing States (SIDS), is needed to deliver more effective and equitable climate resilience actions for vulnerable urban communities in the region.

### Population growth, governance, and informality in Honiara

Honiara is the capital city of the Solomon Islands, an archipelago located in the Melanesian region of the South Pacific. The city is situated on a narrow coastal strip covering an area of approximately 23km<sup>2</sup>, spreading out into a series of rugged hills and valleys to the south, with Iron Bottom Sound acting as a physical boundary at the city’s northern extent. The municipal area is a legacy of British colonial occupation which operates separately to the customary tenure structures that were legislatively recognised during the Solomon Islands’ transition to independence in 1978 (see Figure 1). Four decades later however, the boundaries of the city remain in some dispute with customary land-owners resisting recent attempts to demarcate the land boundary (Foukona, 2015).

The most recent national Census, conducted in 2009, recorded a population of 64,609 within the city boundary, with more recent projections suggesting that the urban

population has now risen to over 90,000 (Figure 2). Of those urban dwellers enumerated in the 2009 census, 55% were born elsewhere in the Solomon Islands (SINSO, 2013), with the largest migrant group being from the island of Malaita (accounting for approximately one third of Honiara’s total population). Indigenous inhabitants of the surrounding province of Guadalcanal – the Guale – make up a much smaller proportion of the urban population, totalling only 2.7%. It is also worthy of note that the majority of non-Guale inhabitants continue to self-identify based on their inherited language regardless of their place of birth (i.e. viewing and describing themselves as being ‘from’ the ancestral island). The number of inhabitants identifying as being from, or associated with, a different island origin can therefore arguably be considered higher than the 55% figure recorded in the Census.

Rapid population growth has been most evident in the peri-urban areas beyond the municipal boundary, with the two neighbouring Guadalcanal Province wards of Tandai and Malango increasing at an average annual rate of 16.4% over the inter-census period. However, the official projections - shown in Figure 2 - need to be treated with a degree of caution as the period of Ethnic Tensions (1999–2003) resulted in a significant displacement of people. Land ownership was a key factor in the conflict between groupings within the local Guale population and the predominantly Malaitan migrants (Ride & Bretherton, 2011). This resulted in an estimated 20,000 people being displaced, equivalent to 20% of the population of Guadalcanal Island at the time (GIDPP, 2004). In addition to returning to their home islands, a number of peri-urban settlers also migrated inward onto alienated land well within the city boundary to avoid conflict with the customary land owners. Although many Malaitans returned to the city following the intervention of an international peacekeeping force (RAMSI) the sensitivity of issues relating to land tenure persists with the majority of subsequent urban growth occurring within the town boundary and in alienated land to the city’s eastern

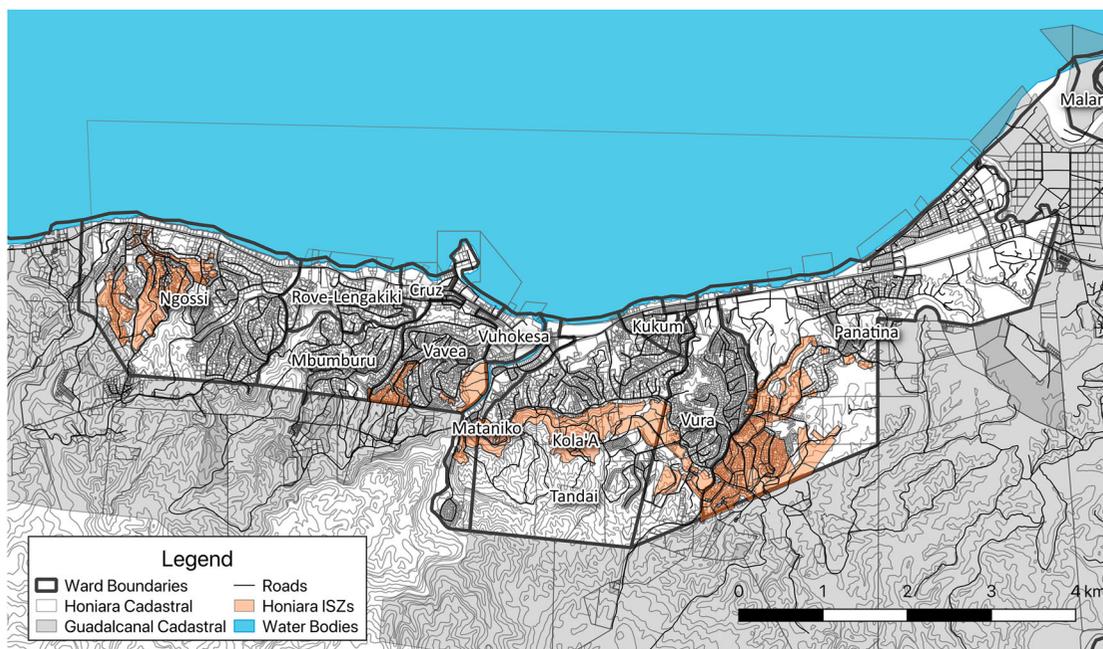
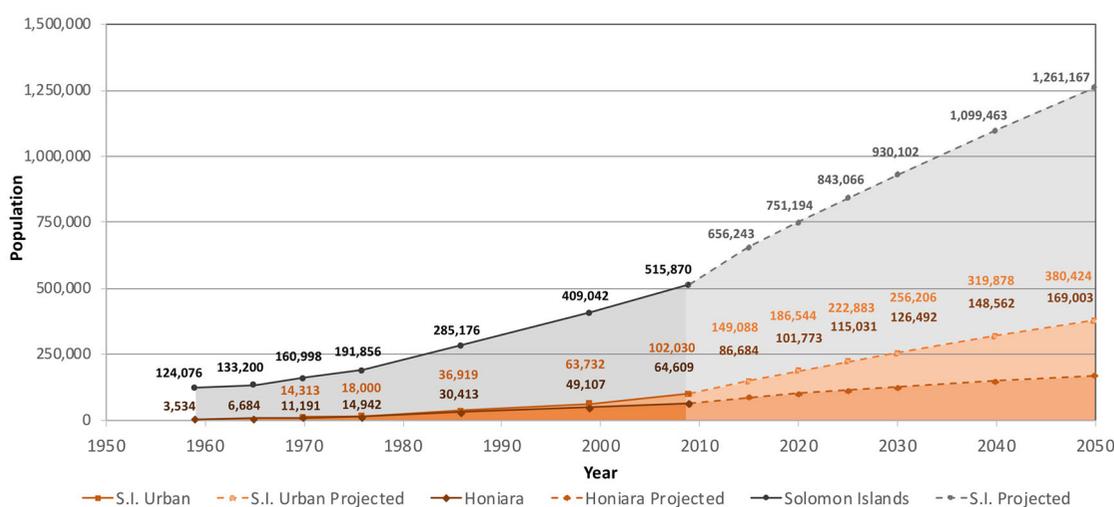


Figure 1. The City of Honiara (data sourced from the Solomon Islands Government).



**Figure 2.** Population Figures: Historical (1959–2009) and Projected (2010–2050) (data sourced from the Solomon Islands Government).

Lunga region (near the international airport and associated industrial areas) (Foukona, 2015).

Contemporary land tenure arrangements in Honiara are the result of a complex history of land releases and formalisation processes that have resulted in – and in some cases encouraged – sustained and widespread informal occupation of government land within the city boundary (Reuben, 2013). These historical issues underlie an ongoing disconnection between traditional extended familial occupation arrangements of Solomon Islanders and Western-style legislative approaches to urban planning and subdivision; a consequence of colonial occupation by the British.

Formal land tenure arrangements within the municipal boundary are granted through Fixed-Term Estate leases (FTEs), which allow the lease of government-held land to an individual or group for a 50-year period. The perpetual title underpinning these lease arrangements is held by the Commissioner for Lands on behalf of the Solomon Islands Government (Foukona, 2015). In peri-urban areas some alienated titles remain, however much of the land directly to Honiara's south and west continues to be held through customary perpetual ownership; with lease arrangements developed through demarcated FTE provisions, informal agreements, and customary arrangements such as *chupu* (which involves payment through feasting, the sacrifice of pigs, and gifting of *kastom* materials) (Foukona, 2017; Kiddle & Hay, 2017).

Temporary Occupation Licenses (TOLs), issued for 3 years, represent an alternative form of government recognition of tenure rights, having been introduced by the British administration before independence in the 1970s to cope with the large number of informal settlers who were already present in the city (Sullivan & Larden, 2007). TOLs were originally intended as a 'stop-gap' response to manage unplanned urban migration and at first only applied in designated Temporary Housing Areas (Foukona, 2015), but these areas have continued to expand their footprint over time. However, the overwhelming majority of TOLs have now lapsed, to the point that only 10 out of a sample of 3,000 TOL households were found not to have expired in a 2006 audit (cited in: Moore, 2015). Government efforts to convert TOL areas to FTE through surveying and

valuation are underway, but lack the resources to keep up with the sheer scale and pace of informal urban growth (*ibid*).

At present, more than one third of Honiara's inhabitants reside within Informal Settlement Zones (ISZs), with informal occupation also extending beyond these government-defined areas to road-sides and road-accessible areas throughout the municipality (UN-Habitat, 2012). More recent estimates by UN-Habitat, in an unpublished document in 2016, suggest this figure has risen to 40% (UN-Habitat, unpublished). It is projected that without a rapid acceleration in land releases by the Solomon Islands Government, informal settlements will comprise more than half of Honiara's total population in the next couple of years (UN-Habitat, 2017). However, important caveats need to be highlighted due to the complex relationship between informal settlements and (in)security of tenure in the South Pacific (for a useful overview, see: Mecartney & Connell, 2017). Firstly, it should be noted that informal tenure does not necessarily mean insecure tenure, and where informal tenure is perceived to be secure it can actually offer the potential to provide a level of flexibility for adaptation responses that more formal tenure systems such as freehold do not. For example, families moving from outer islands to Honiara may first move in with relatives, and then build a small dwelling next to their relatives' house. On land that has not been formalised (i.e. without a certificate of occupancy) they are less constrained by land boundaries when siting the new dwelling (Trundle et al., 2018). Furthermore, as Keen and Kiddle (2016) note, investment in informal settlements in Honiara is most strongly correlated with the time spent in place than legal tenure, with the settlers' perception of security of tenure acting as a key driver of housing investment. Whilst this is outside the scope of this particular paper, the relationship between perceived security of tenure and adaptive capacity is less well understood and worthy of further investigation in the South Pacific context.

### Climate vulnerability in Honiara's informal settlements

Climate vulnerability can usefully be expressed as a function of *exposure* to a hazard, the *sensitivity* of different elements at risk,

and local *adaptive capacity* to respond in the event of – and subsequent to – a hazard occurring (UNH CCCI, 2014). A visualisation of the vulnerability framework is shown in Figure 3. As highlighted in the 2017 UN-Habitat HURCAP, the city has historically been subject to a wide range of severe climate and geological hazards; with impacts amplified by substantive shortfalls in urban development and infrastructure. Climate-related risks relevant to Honiara – such as flood events, extreme heat, drought, sea level rise, ocean warming and acidification, and landslides – are projected to increase in intensity and frequency in future years due to climate change (PACCSAP, 2014). However, due to the high levels of exposure and sensitivity to extreme events, as well as limited adaptive capacity, the current day vulnerabilities of informal settlements to climate-related events were therefore prioritised over future climate change (for full details of the climate vulnerability assessment methodology and findings, see: Trundle & McEvoy, 2017). Local actions are necessary to make urban communities more resilient to a combination of urbanisation and climate-related drivers.

Sea level rise is the most common hazard discussed with respect to SIDS such as the Solomon Islands however not all SIDS are equally exposed. According to data from the Center for International Earth Science Information Network (CIESIN, 2013) Tuvalu and Kiribati are two of the most at risk in the Pacific region with 33% and 55% of their land under an elevation of 5 m respectively. However other nations, such as the Solomon Islands (1.6%), are less exposed to the threat of coastal inundation. However, a rise in sea level will introduce other emergent threats; with heightened storm surge exposure, increased coastal erosion, and salinisation of critical groundwater resources likely to have increasing impacts into the future (CSIRO, BoM and SPREP, 2015; Trundle & McEvoy, 2017).

The assessment of climate vulnerability undertaken for HURCAP identified a strong spatial correlation between informal land tenure and vulnerability to climate impacts (shown in Figure 4). Heightened vulnerability is present in most - if not all

- areas of informality in Honiara i.e. settlements tend to locate in areas unable to be formally developed due to hazard risk (such as flood plains and landslip sites); they commonly lack access to urban infrastructure and basic services; and their lack of tenure legitimacy results in isolation from government disaster response services, health facilities, and restricted access to information and expert knowledge to inform potential disaster risk reduction and climate adaptation actions (Trundle & McEvoy, 2017).

It is important to note that while a lack of formal land tenure and property rights isolates informal settlements from government and disaster response services, the strength of community structures can act as an alternative form of adaptive capacity. This was highlighted in a city-wide stakeholder assessment of adaptive capacity (Figure 5), which demonstrated the perceived strengths and critical roles of community-level climate awareness and leadership at the city level (Trundle & McEvoy, 2017). Examples cited included the coordination of community fundraising following disaster events, informally arranged temporary housing and improvised evacuation centres (through either community structures or *wantok*<sup>1</sup> social networks), and detailed understandings of flood and other climate risks that had been communicated by community elders and leaders (*ibid*).

### The relationship between land tenure and climate vulnerability in two informal settlements

In the context of Greater Honiara, 10 distinct types of informal settlements were identified which reflect the different sources, levels, and spatial extent of land tenure rights (Trundle, 2017: see Figure 6). Using this typology, which builds on the understanding that there is a ‘continuum of land tenure rights’ from informal to formal (GLTN, 2008), two contrasting climate vulnerability ‘hotspots’ were selected for in-depth analysis as part of the GLTN land tenure and climate vulnerability study and hosted community workshops in 2018. These were depicted in Figure 4 previously; *Kukum*

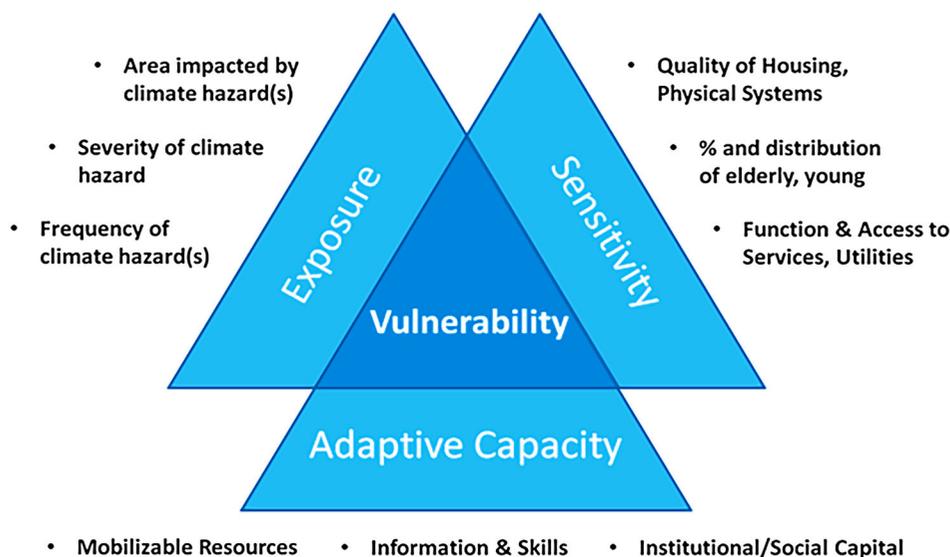


Figure 3. Climate Vulnerability Framework and Examples (Trundle & McEvoy, 2017).

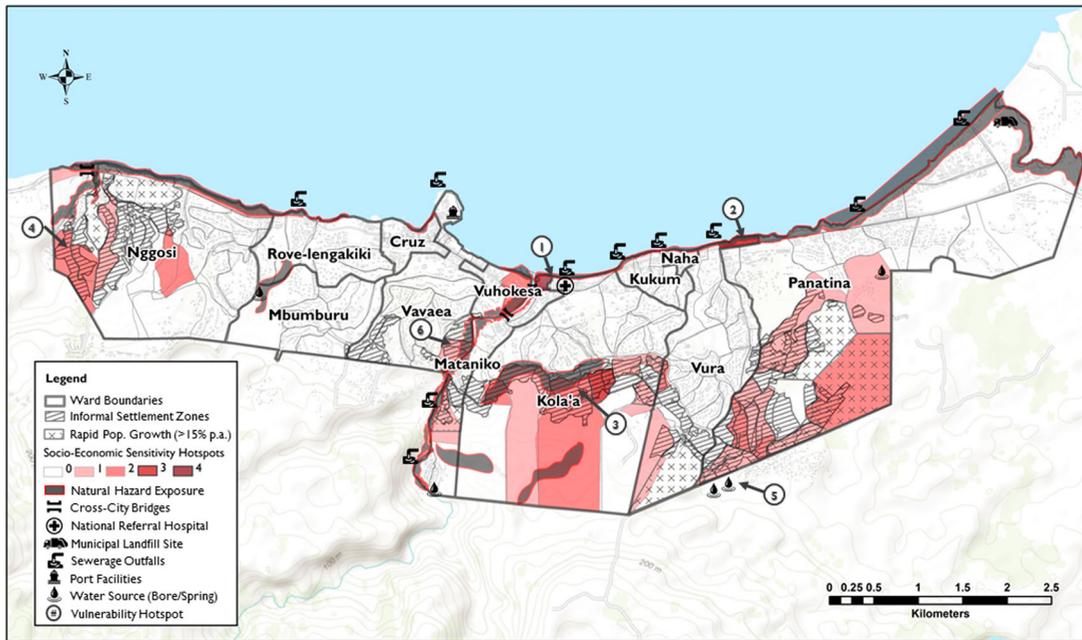


Figure 4. Overlay Map Showing the Outputs of Honiara Climate Vulnerability Assessment (Trundle & McEvoy, 2017).

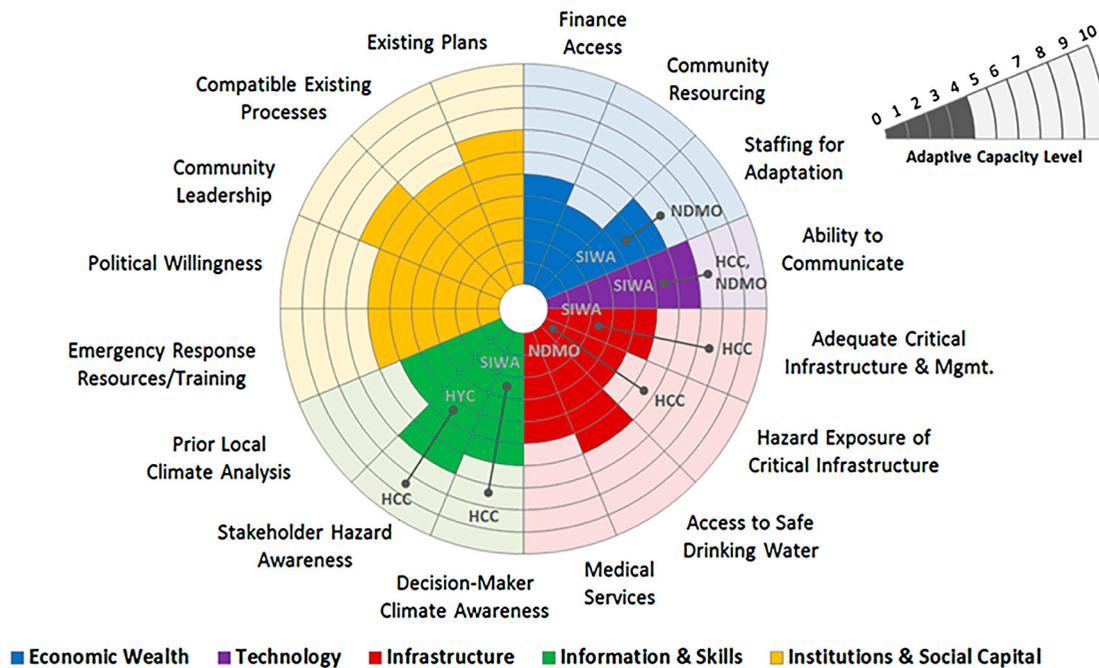


Figure 5. Honiara City-Wide Adaptive Capacity Assessment Outputs (Trundle & McEvoy, 2017).

*Fishing Village* (Hotspot 2) and the *Aekafo-Feralado Informal Settlement Area* (Hotspot 3). Each occupies a site highly exposed to a range of climate-related hazards and have differing (and internally varied) land tenure rights, which allowed for an exploration of the relationships between land tenure and climate vulnerability (framed in terms of exposure, sensitivity, and adaptive capacity). Both settlements were identified as being vulnerable to climate change impacts in the original climate vulnerability assessment (Rodil & Mias-Cea, 2014) and will be involved in implementing community resilience actions identified in the HURCAP as part of the new Adaptation Fund project (2018–2022).

### Informal settlement 1: Kukum Fishing Village

Kukum Fishing Village is a settlement that spans roughly 200 m of coastline to the east of central Honiara, wedged between the main Kukum Highway and Iron Bottom Sound (Figure 7). The first settlers arrived in the early 1960s, and the village has now grown to now accommodate more than 60 households with a total population of 463 in 2009 (Rodil & Mias-Cea, 2014). The village plays an important cultural, economic and nutritional role in the city, and supplies much of the adjacent Honiara Fish Market with produce.

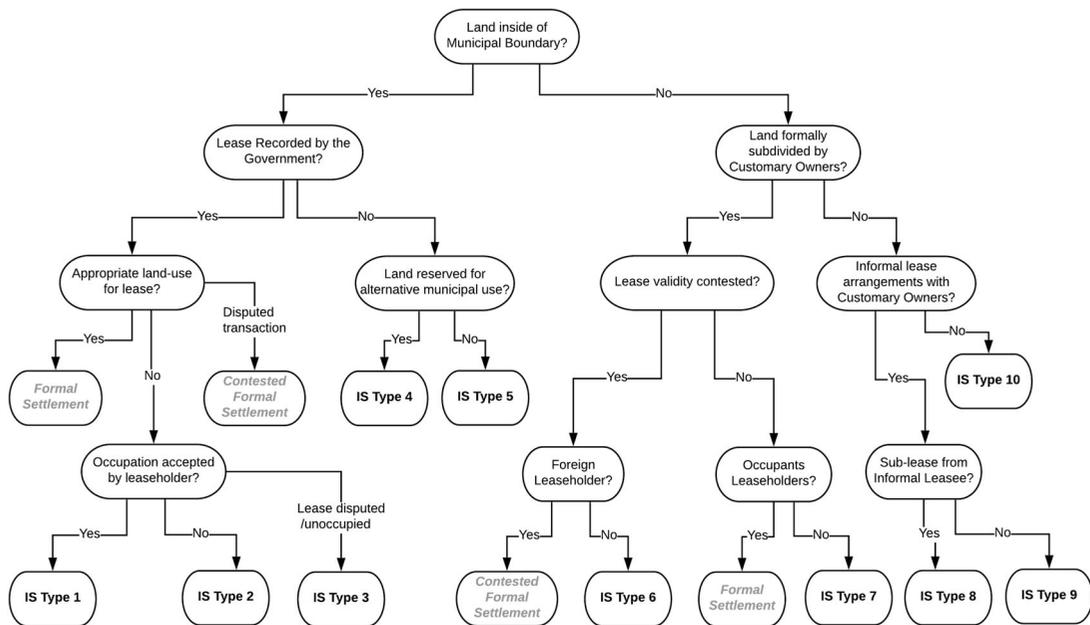


Figure 6. Decision-Tree Typology of Informal Land Tenure in Greater Honiara (Trundle, 2017).



Figure 7 –Fishing Village Aerial Photograph and Subdivisions (Ministry of Lands, Housing and Survey, Unpublished).

Originally known as ‘Vaivila’, Kukum Fishing Village was established by Malaitans from the Lau and Langa Langa Lagoons, who identified with the coastal environment (having traditionally established their housing on artificial structures adjacent to reef areas) (Moore, 2015). As Moore observes, the settlement’s social hierarchy built upon clan structures from their home island; patterns that continued to be evident during workshop activities. Within the settlement, seven established kinship groups were identified by the community: Taralamoa; Gounaramo; Aenabaolo; Ntankaro; Ferailalo; Nalobo; and Sub-aro. An eighth grouping, Foeda, was also noted by community

representatives, but not considered to be as strongly established as the seven other sub-groups.

As is visible in Figure 7, although much of the land adjacent to the Kukum Highway has been formally subdivided, many of these dwellings do not align to demarcated land boundaries and have expanded into routes originally designated for access and service provision. Further land reclamation to the settlement’s north has been done without any official lease modifications or tenure arrangements, having largely been developed as extended family moved into the area over time (with household relatives building northwards from the defined allotments).

Although most households have access to piped water (74%), a quarter only has access through shared multi-household connections. Only 26% of households have access to private flush toilets, with many others using shared drop toilets that extend over the water at the northern extent of the settlement. Roughly a third of the inhabitants were recorded as disposing of their rubbish into the ocean in the 2009 national Census (*ibid*).

Fishing Village, due to its coastal location, is one of the most exposed areas of the city to climate-related hazards. Storm surges are particularly problematic, with the settlement lacking coastal defences and having experienced heavy erosion during previous cyclone and storm events. Most notably, a major cyclone in 1951 destroyed the Kukum Wharf, while Tropical Cyclone Glenda in 1967 destroyed Fishing Village in its entirety (Rodil & Mias-Cea, 2014). The whole settlement is also less than 5 metres above sea level, presenting an increasing risk of damage from storm surge as climate change continues to drive cyclone intensity, storm surge height, and sea level rise.

The settlement is densely occupied, with roughly 115 persons per hectare (in 2009) and an average household size of more than 8 extended family members. This density further increases dwellers' sensitivity to extreme heat with newer buildings blocking coastal breezes, as well as vehicle access (a potentially critical issue if rapid evacuation before an extreme event is needed). Exposure to extreme heat conditions is likely to further increase with climate change, with average annual temperatures likely to increase by 2.0–4.0°C by 2090 under a very high emissions scenario (cited in: Trundle & McEvoy, 2017).

Within the settlement, the widely recognised social status and chiefly structure of the village, as well as their legal tenure status (albeit partial, due to unauthorised housing that has been built by extended family members on sub-divided land), were viewed as providing the community with more security of tenure and potential adaptive capacity than communities in government-classified Informal Settlement Zones. However, the ongoing lack of resourcing for coastal defences; as well as the inability to prevent encroachment of housing into designated access routes suggests a level of disconnection from formal urban governance processes.

Community workshops on land tenure and climate vulnerability were held in late 2017 and built on previous engagement activity during the development of the HURCAP. Participants identified 25 blocks that had formal rights held as FTE. These are the only properties with formal connection to water and electricity, and having sanitation facilities. Approximately 30 houses were identified as being unauthorised with their occupants reliant on those with FTE for access to essential services (excessive use of water and electricity through these arrangements was noted as an issue). The existing FTE land holdings are also densely populated, with as many as 8 families living on one block. It was estimated that there are 3–5 families living in each house (both formal and informal). The majority of unauthorised housing is on the marine side of the community with the main road effectively restricting any new building inland.

When discussing the link between resilience actions and land tenure with the community, one suggested response to the issue of overcrowding, and the problems being caused by

unauthorised housing, was to demolish housing on the seaward side and construct a seawall along the high water mark. This would encourage relocation of newcomers and those not registered or holding FTE's (including extended family). However, it was stressed that in return for giving up their homes, affected families would need to be supported in their relocation by the Ministry of Lands, Housing and Survey (MLHS), with the provision of essential services and FTE's being offered at low cost or for free. New community rules to avoid unauthorised housing development in the future were also considered necessary by workshop attendees.

## Informal settlement 2: Aekafo-Feraladoa informal settlement area

Aekafo-Feraladoa is Honiara's largest informal settlement area, extending up to the ridgeline either side of Vara Creek, a tributary of the Mataniko River. It was established by Malaitan migrants in the late 1960s, with settlers initially setting up gardens in the valley before building housing in subsequent years. It was one of the first 'squatter settlements' recognised by the then British Protectorate (DoG, 1967), with TOLs being granted to many of its occupants in the 1970s (Sullivan & Larden, 2007). However, many of these have now lapsed.

The settlement contained 822 households at the time of the 2009 national Census, with a total estimated population of 5183, having increased at a rate of 15% per year since a comprehensive survey by the MLHS four years earlier (Trundle, 2018). Seven government-classified Informal Settlement Zones (ISZs) are contained within the area (however the community actually identifies eight distinct areas which are labelled in Figure 8).

Around three-quarters of the inhabitants identify as originating from the island of Malaita, with the name 'feraladoa' reflecting this (meaning 'to build a house and keep extending it' in the Malaitan Kwara'ae language). However, the 8 communities are largely of mixed island-origin community governance structures, which are similarly reflected in shared cross-denominational church spaces. Allotment configurations also differ by community zone; a 2015 UN-Habitat household survey estimated plot sizes in Cana Hill as being, on average, 1,332m<sup>2</sup>, in contrast to Aekafo (594m<sup>2</sup>) and Gwaimaoa (695m<sup>2</sup>).

Their climate exposure is reflective of the topographic features that define much of the settlement, with steep valley slopes leaving many dwellings at risk of landslips and mudslides, while inhabitants of the valley floor face the additional risks of flash flooding (added to by debris and landslip material during heavy rain events). These conditions are projected to continue to increase in frequency and strength under climate change: a 1-in-20 year extreme rainfall event (approximately 220 mm of rainfall in a 24-hour period) would occur once every 4 years by 2090 under a worst case, very high emissions scenario (RCP8.5), at which time a 1-in-20 year event would instead result in approximately 20% more rainfall, equivalent to 263 mm in a single day (Trundle & McEvoy, 2017).

MLHS, in partnership with UN-Habitat, has worked extensively with these communities over a number of years establishing Community Development Committees (shown in Figure 9). These Committees, and their associated sub-committees, have

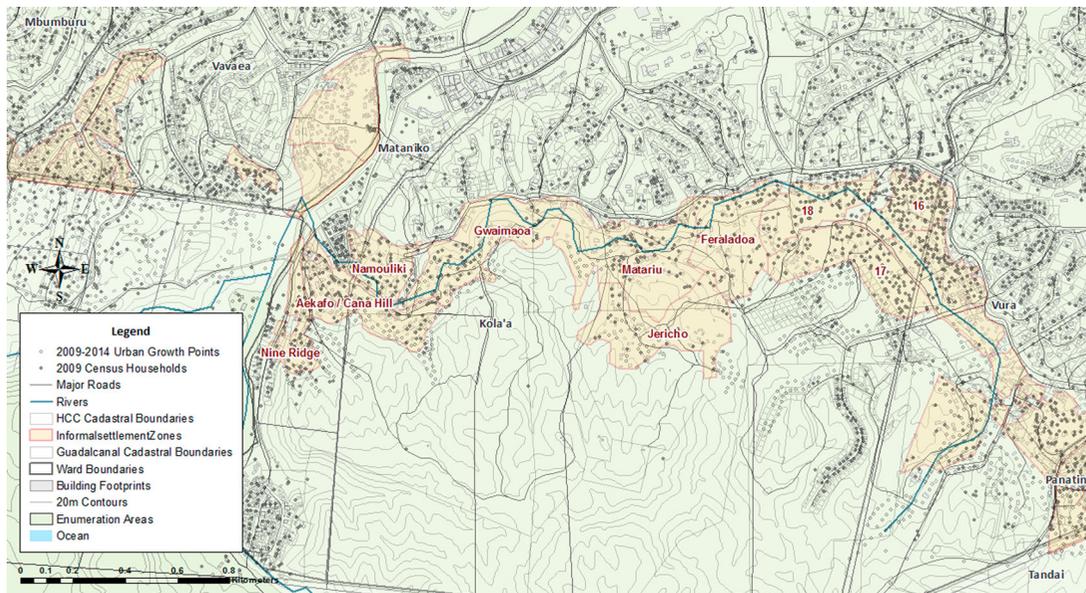


Figure 8. Aekafo-Feraladoa Informal Settlement Zones (Trundle, 2018).

been the key governance mechanism for engaging with formal urban planning and governance structures in the city, and have also enabled the implementation of non-government, donor and multi-lateral initiatives in the community (such as the World Bank’s Rapid Employment Project). Notably MLHS is also engaged in the process of formalising much of the settlement through allotment surveying and valuation, and is developing neighbourhood level plans for infrastructure, road reserves, and community facilities. However, it remains to be seen whether these formal efforts can keep pace with the ongoing southward expansion of the settlements as the city continues to grow rapidly.

As a consequence of its upland rugged geography, the three key resilience actions previously identified in the HURCAP were: 1) sanitation and drainage, 2) waste management, and 3) provision of drinking water. Water was cited as the most important issue for families; with the need for upgraded

washing areas along the local stream (whilst two zones have 100% access to piped water from Solomon Island Water Authority, the national water utility, others are reliant on springs or boreholes for their water supply). Most of the communities are reliant on ‘pour flush’ toilets.

The land tenure workshop found that there are almost no FTEs in this settlement; rather, occupants are reliant on TOLs (the vast majority of which are lapsed). Only one zone has a 100% connection rate for electricity, with other zones are reliant on solar power to varying degrees (two zones have no connection at all and have to rely on solar power for their power needs). Critically, workshop participants highlighted the requirement for a land title in order to be able to access water and electricity services; as well as being eligible for bank loans. A further key community priority was to prohibit housing development in high risk areas such as steep slopes (landslides) and river valley floors (flash floods).

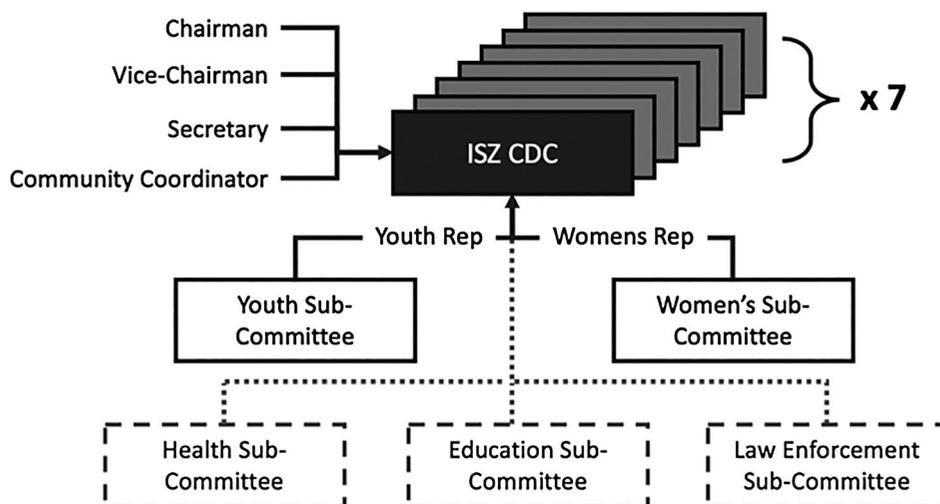


Figure 9. Community Structures (current and proposed) and CDC Representatives.

## Exploring the links between land tenure and climate vulnerability

The first contributing factor of insecure land tenure to increased vulnerability relates to *exposure* to hazards. People migrating into the city, or the surrounding peri-urban area, commonly settle on the only land that is perceived as being available to them (taking into account the risk of eviction, contestation and access to urban services etc.). These are areas that are often the most marginal urban land at highest risk of being impacted by hazard events (e.g. informal settlements in the Koa Hill floodplain which were impacted by the major 2014 flood leading to fatalities or, as in the case of Aekafo-Feraladoa, on steep slopes at risk of landslides or valley floors that are subject to regular flash flooding). Even when newcomers have the benefit of locating to existing settlements through *wantok* ties, as is the case for Kukum Fishing Village; new housing is spreading seawards and illegally filling up sub-divided plots of land. These are not only exposed to heightened coastal risks such as storm surge and erosion but are contributing to ever increasing overcrowding of the settlement; leading to the blocking of access routes (important for emergencies), impacting ventilation corridors with implications for heat exposure, and generating an increasing level of discord with longer-established community members.

The second element of vulnerability relates to the *sensitivity* of elements at risk in the urban environment. In both communities, housing without a formal land title is necessarily 'temporary' and therefore often (though not always) of poor build quality. Consequently, these dwellings are highly sensitive to extreme events such as cyclones and storms (as well as contributing to the danger of death and injury by adding building materials to flying debris). Furthermore, as was found in both case studies, a lack of formal land title also restricts access to essential services such as water and electricity; although some families in Kukum Fishing Village share access to services with extended family in those houses with FTE (however, instances of illegal connections were also noted). Inadequate sanitation facilities were also identified as a significant problem in both communities. Limited access to basic services and health facilities is a direct consequence of not holding a formal land title; ultimately contributing to high levels of climate sensitivity in the informal settlements (health risks, for instance, will be exaggerated by future climate change).

The *adaptive capacity* of individuals and communities is also influenced by insecure land tenure. Not only do informal settlers have restricted access to critical infrastructure, they lack the financial resources and information necessary to be able to better prepare for, and respond to, climate-related extreme events such as flooding and storms. Being outside urban governance structures and processes, they also find themselves disconnected from decision-making processes and – particularly in the case of peri-urban areas – excluded from formal Disaster Risk Reduction (DRR) activities. The ability of informal settlers to adapt is therefore hampered as a direct consequence of their tenure insecurity.

Good land governance initiatives that aim to reduce insecurity of land tenure will, at the same time, increase the climate resilience of the most vulnerable communities in the city;

**Table 1.** Potential approaches and tools for improved land governance.

1. **The continuum of land rights** – involves planning for all occupation of land including informal settlers without TOL or FTE, focussing on context-specific approaches to improving perceived tenure security, rather than only formalisation.
2. **Tenure responsive land use planning** – involves land use planning informed by cadastral mapping and understanding of tenure security, as well as by hazard risk. Key challenges include identifying suitable land for resettlement, slum upgrading, water catchment and infrastructure, and also for emergency shelter and for camps for short term displacement after disasters.
3. **Fit-for-purpose land administration** – to identify low-cost ways of improving the efficiency of land administration processes and build capacity to respond to land issues needed to support resilience actions.
4. **Participatory and inclusive Land Readjustment (PiLAR)** – involves the community in upgrading and resettlement processes providing perceived security of tenure for all.
5. **Mainstreaming climate change considerations into land administration** – allowing all decisions about land tenure and land administration to be based on awareness of hazard risk, including resettlement decisions and emergency response decisions.
6. **Cadastral mapping and land tenure security assessment** – are important for community resilience actions affected by encroachment of housing, and to identify informal settlers without TOL or FTE.
7. **Social Tenure Domain Model (STDM)** – a pro-poor land administration tool that can be used for participatory enumeration, suitable for local climate vulnerability and disaster assessment contexts.
8. **Gender Evaluation Criteria** – a tool to assess the gender-responsiveness of policies, laws and processes related to land and climate (as women bear the brunt of the impacts of climate and natural disasters, addressing these inequalities can have a big impact on household adaptive capacity).
9. **Alternative land conflict resolution mechanisms** – there is a risk of inflaming existing tensions over land or creating new tensions. Local, culturally appropriate approaches to land dispute resolution may be more responsive than formal processes.

reducing their exposure and sensitivity to climate risks and enhancing local capacity to adapt. Good land governance and actions for climate resilience can therefore be considered to be mutually reinforcing (conversely, poor land governance leads to reduced adaptive capacity). Potential approaches and support tools for improving tenure security are showcased in [Table 1](#).

## Conclusions

The need to consider urbanisation processes as well as planning for climate change is increasingly recognised by local policy-makers; as evidenced by the first Solomon Islands National Urban Forum in June 2016 and more practical 'on-the-ground' efforts such as the UN-Habitat 'Participatory Settlement Upgrading Programme' (PSUP) and Solomon Islands Government initiatives to formalise the more established informal settlements across the city. As part of this formalisation agenda (and responding to the need to rehouse those displaced by the 2014 flooding of the Mataniko River), new land was released by the 'April Ridge' relocation initiative (involving the offer of 225 plots with FTEs). However, this new initiative has not been without criticism, with voices critical of a complicated land tenure system, lack of adequate supporting infrastructure, and restricted access to financial credit (Ha'apio, Morrison, Gonzalez, Wairiu, & Holland, 2018). Supported by anecdotal evidence from community workshops, it is clear that there is room for improvement in the processing of land titles and the establishment of new housing development areas. Other examples of changing urban land policy in Honiara include a new, community-enforced ban on development in the Koa

Hill floodplain and the establishment of an upstream conservation area to maintain the integrity of water supply and restrict development in this highly sensitive area.

Without targeted development of regional areas in the Solomon Islands, the contemporary trend of migration to the capital city will continue. Given the sheer scale of informality in Honiara already, and the likely continued growth due to rural-to-urban migration, appropriate land will need to be identified and released for new housing development as a matter of urgency. There are opportunities for this to happen within the confines of the municipal boundary (either through earmarking new land for housing or upgrading existing settlements), however due to the scale of the informality challenge additional land for housing is also likely to be needed and will have to be negotiated with Guadalcanal Province – and customary land owners – in order to establish new uncontested developments in the peri-urban areas surrounding the city. A program of releasing land in low-risk areas, providing access to basic services (as well as ensuring road links), and enabling people to hold formal land titles, will not only improve tenure security but also enhance the resilience of communities to climate impacts.

Due to the evidence of strong inter-linkages between land tenure and climate vulnerability, responses to formalise land tenure will make positive contributions to multiple global frameworks. Action is relevant not only to the Sustainable Development Goals (SDGs) [particularly Goals 6 (clean water and sanitation), 11 (sustainable cities and communities), 13 (climate action) and 16 (peace, justice and strong institutions)], but will also contribute directly to the goals of the Sendai DRR Framework (reducing vulnerability to extreme events), the UNFCCC Paris Climate Agreement (dealing with the impacts of climate change) and UN-Habitat's New Urban Agenda (providing basic services for all citizens, strengthening urban resilience, and striving for equity in cities).

As highlighted throughout this paper, the sheer complexity of the spectrum of land tenure arrangements – FTE, TOL, lapsed TOL (commonplace), informal arrangements with land owners, and illegal squatting on both leased and government-owned land – has a significant influence on the climate vulnerability of groups and individuals, as well as their ability to implement adaptation measures that enhance resilience to climate-related and natural hazards. This complexity is further enhanced by a currently limited understanding of how households' perception of tenure security (rather than holding a formal land title) influences their investment in housing (and hence reduces their sensitivity to climate-related impacts).

Consideration of complex land tenure issues therefore needs to be central to climate vulnerability assessments and adaptation planning to ensure that urban resilience is an equitable and locally appropriate endeavour. However, given Honiara's history, recent ethnic tensions, ongoing boundary disputes, and limited resources; this will undoubtedly be a challenging task for policymakers.

## Note

1. 'wantok' is a reciprocal social security system built around extended familial and language networks, stemming from island and tribal diasporas that are present across Honiara.

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No potential conflict of interest was reported by the authors.

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