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Peripherality as key to understanding opportunities and needs for effective and sustainable climate-change adaptation: a case study from Viti Levu Island, Fiji

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ABSTRACT

A study of various defining aspects of 11 rural communities along the cross-island road on Viti Levu (Fiji) shows diversity attributable largely to their peripherality, proxied by distance along this 200-km long road. Strong relationships are found between peripherality and both community size and the dependency ratio (percent of young/old dependents), as well as traditional medicine usage (and percent traditional healers), and autonomous community coping after disasters. Two measures are calculated to capture community autonomy, both of which proxy peripherality.

Results show the usefulness of peripherality as a way of measuring community diversity in developing-country contexts. Peripherality also correlates with community autonomy, more-peripheral communities having greater autonomous coping abilities/capacity than near-core (less-peripheral) communities. Results also show the unhelpfulness of the default “one-size-fits-all” approach to communities implicit in many external assistance programs. Yet while traditional coping in such communities may not be able to fully overcome future climate-change challenges, the conservation of the traditional knowledge underpinning this should be encouraged, mainly because of the likelihood that external funding for future adaptation in such communities will be inadequate. The best hope for effective and sustainable adaptation to future climate change, focused on sustaining livelihoods, lies in strengthening autonomous community coping.

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1. Introduction

While the utility of global perspectives in framing future challenges from climate change is undisputed, adaptation pathways involving the uncritical downscaling of global solutions are not always as effective and sustainable as anticipated. While in some cases attributable to various barriers as well as the diversity of societal and environmental contexts not readily captured by such global solutions (Lebel, 2013; Mackay et al., 2018), the outcome has been a sustained failure of external interventions for climate-change adaptation, especially in poorer/peripheral contexts (Chan & Amling, 2019). This has resulted in calls for meaningful localization of such interventions (Mazmanian, Jurewitz, & Nelson, 2013; Thorpe & Figge, 2018) and acknowledgement of the diversity of target groups/communities (Nunn & Kumar, 2018; Nunn, Aalbersberg, Lata, & Gwilliam, 2014).

Another reason for the failure of such interventions has been their often uncritical imposition of generic/global solutions in situations where key (target-community) stakeholders may neither be aware of the underlying science nor sufficiently convinced of the long-term efficacy of science-based solutions to embrace them unconditionally (Fazey, Pettolelli, Kenter, Wagatora, & Schuett, 2011; Lata & Nunn, 2012). This is especially true in contexts where key decision-makers have insufficient science training to be able to comprehend the broader challenges but also – as is common throughout the developing world – where such people privilege spiritual over secular explanations for observed phenomena (Fair, 2018;

Schuman, Dokken, van Niekerk, & Loubser, 2018). Recognizing such issues has led recently to calls for increased acknowledgement of the value and utility of traditional/local knowledge/worldviews in such communities, a shift likely to increase their ownership of adaptation solutions and sustain these (Granderson, 2017; Leon et al., 2015; Nalau et al., 2018).

This study addresses global and local perspectives on climate change in a range of traditional communities in a developing-world context. Communities exhibit various degrees of coping with environmental adversity depending largely on their degree of peripherality: the distance (and the time taken to travel that distance) of a particular community from a globally-connected (urban) centre. As proposed by Nunn and Kumar (2018), more-peripheral communities usually have a greater stock of traditional knowledge and use it more often than less-peripheral (near-core) communities that are usually more globally exposed. This study assesses whether, as many interventions implicitly assume, increasing global awareness is key to effective and sustainable adaptation in such contexts or whether in fact growing the support for local/traditional knowledge is of at least equal importance.

The study reported here is based on in-depth surveys of 11 rural communities strung out along the sole cross-island road on Viti Levu Island (10,388 km²), the largest in the Fiji group (Southwest Pacific). Section 2 describes the study area and the particularities of the communities studied. Section 3 describes how data were collected. Section 4 gives the main

results of data analysis. The interpretation of results in Section 5 explains how key data, readily collected in such places, could be used for the rapid large-scale assessment of peripherality that would guide the development of effective and sustainable solutions for future climate-change adaptation.

2. Study area

Islands, especially those in the middle of oceans, are widely acknowledged as being disproportionately exposed to climate change (Kelman, 2018; Nunn & Kumar, 2018). While the most common and widespread challenges to island people's livelihoods attributable to climate change arise from their concentration in coastal areas that are affected by sea-level rise, other parts of island countries will also be impacted – directly or indirectly – by the effects of future climate change, including extreme wind/wave events as well as more insidious phenomena like rising temperature, changes in seasonality and drought incidence.

People live on some 90 islands in the Fiji archipelago, most on the largest island Viti Levu where the largest cities are located as well as most infrastructure and the greatest opportunities for cash employment. In terms of the distribution of people and the ways in which they live, the interior of Viti Levu is more similar to other (outer) islands in the group. From the wetter/windward southeast side of the island, there is only one cross-island road, not always passable, built in the 1970s to allow construction of hydroelectric dams in the high centre of the island where elevations reach around 1300 m (Chung, 1988; Nunn, 1998). 11 communities were visited along this road and data gathered from a representative range of informants to help understand the nature of contemporary livelihoods and the growing climate-linked challenges to these (Figure 1).

To some degree, most of these communities subsist from foods they either grow or collect from the environments that

surround them. For many communities, the only water sources are nearby rivers and springs while electricity supply is largely from household/group generators and/or small solar-panel systems. While opportunities for wage employment are greater in some communities, most households acquire cash income from the sale of commercial/surplus crops notably *taro* (*Colocasia esculenta*), a common staple, and *kava* (*Piper methysticum*), an important social/ceremonial drink in Fiji and elsewhere. Landowning units (*mataqali*) in some communities also gain an income from leasing land they own (87% of land in Fiji is 'native-owned' and available only for lease) or from selling its resources, like timber.

Like most rural Pacific Island communities, those studied are largely coherent, their members identifying as part of multi-generational place-grounded groups that support one another, to which end they often engage in communal activities – whether social or end-focused – and are networked within their broader areas and beyond (Ravuvu, 1987). Decision-making in such communities is rarely consensual, often determined by elderly (male) hereditary clan leaders whose understanding of particular issues may neither be informed by (scientific) fact nor by government legislation which often proves difficult to explain/enforce in such places (Nunn et al., 2014; White, 2015).

All communities studied are inland although the subsistence livelihoods of those at the extremities of the transect intersect – directly or indirectly – with nearshore marine ecosystems. Except for Korovou, all communities studied are sufficiently far from the ocean to be buffered from its direct impacts although the interdependence of all these communities with those along the coast means that they are indirectly affected by coastal impacts of climate change. For most communities along the cross-island road, their dependence on vehicular transport along roads that are often steep, sinuous and mostly unsealed (which exposes them to heavy rain) means that tropical cyclones (hurricanes) in particular can reduce accessibility

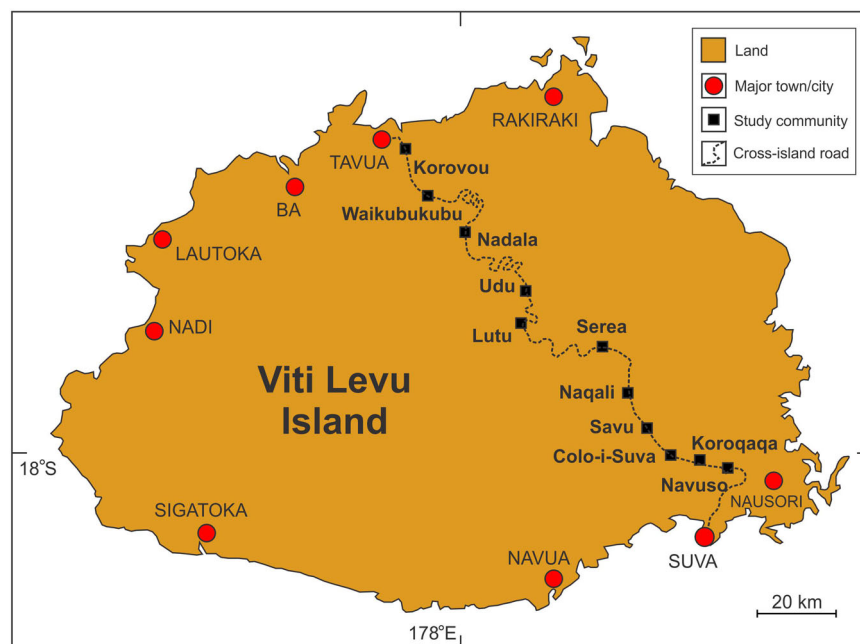


Figure 1. Location of the cross-island road on Viti Levu, the largest island in the Fiji archipelago, together with that of each of the 11 communities studied.

and – through sheet runoff and mass movements on steep planted slopes – can negatively impact livelihoods. River flooding, landsliding and drought are the other major natural hazards affecting this island's interior.

Plausibly because of their comparative isolation, there is generally more community autonomy (and local-area interdependence) among communities from Nadala to Lutu inclusive than in the others. Geography can also explain much of the historical independence of the people in this area (and the rest of central Viti Levu) who were the last in Fiji to bow to colonial rule in the 1880s (Nicole, 2011; Weir, 2014).

3. Data collection

Data were collected through the use of a detailed set of questions under eight headings: population and economy; transport and infrastructure; government services and education; health; communications and technology; culture, tradition and religion; climate, natural disaster prediction and response; water, diet and food production. The same questionnaire was used by Nunn and Kumar (2019) and is published therein. Data were collected from communities in March–October 2018, mostly through focus-group discussions, the most effective way of gathering information in such contexts (Lata & Nunn, 2012). In most communities, more than one set of data was acquired from groups organized by age group and gender to maximize the chances of identifying all key issues. Across the 11 communities, data were obtained from 36 focus groups (7 mixed, 14 female, 15 male) involving a total of 234 adults (48.3% female, 51.7% male).

Focus groups averaged 6–7 adults who were asked a series of questions in their preferred languages (spoken by all authors) to which they generally provided answers by consensus, the usual practice in these contexts. Potential disagreements were usually resolved by deferral to the eldest or highest-ranked individual in the group. Not all data collected is reported in this paper.

4. Results and interpretation

For the study reported here, only those data referring to community characteristics attributable to peripherality are discussed. In Table 1, the actual distance along the cross-island road between a community and the centre of the nearest coastal city (either Suva in the south or Tavua in the north) is considered the principal measure of community peripherality. Other key data refer to population, specifically the total size and crude age distribution (measured by the Dependency Ratio); the cost/time involved in visiting either Suva or Tavua hospitals (often to consult a nurse/doctor, not necessarily for admission), medicine preference and frequency of use of traditional/western medicines; and degree to which both disaster preparedness and post-disaster recovery depend on external support or internal (culturally-grounded) community knowledge.

Several types of information that characterize community peripherality in other contexts (e.g. Beer, 2004; Copus, Skuras, & Tsegenidi, 2008) are not as useful here. These include data about employment because few people without regular access

Table 1. Peripherality data from communities along the cross-Viti Levu island transect.

Community	Shortest road distance (km) to Suva or Tavua (full-service) hospital ¹	Community size	Dependency Ratio (%persons <21 and >65)	Cost/time of return (full-service) hospital visit (Fiji\$/hour)	Average frequency of (full-service) hospital visits (per year)	Medicine preference (1 traditional; 2 western; 1.5 equal)	Average frequency of traditional medicine use (per year)	Number (%) of traditional healers in community	Post-disaster recovery (% times outside help received in past five years)	Use of traditional coping strategies post-disaster (1 common; 2 rare; none)
Colo+Suva	12.6	205	28.8	2.2	8	1.5	48	3 (1.5)	33.3	2
Koroqaqa	22	320	40.6	2.9	2	2	24	1 (0.3)	100.0	1
Korovou	5.1	686	51.7	5.8	4	1.5	24	6 (0.8)	50.0	1
Lutu	94.1	141	23.4	3.4	1	2	18	3 (2.1)	54.5	1
Nadala	44.3	210	46.2	2.5	1	1	48	3 (1.4)	40.0	1
Naqali	33.6	569	30.6	2.8	4	2	24	5 (0.9)	20.0	2
Navuso	12.9	500	22.6	7.0	8	2	36	3 (0.6)	0.0	2
Savu	31.6	258	49.2	2.4	2	1	48	5 (1.9)	16.7	1
Serea	55.3	94	54.3	3.5	8	2	12	2 (2.1)	25.0	1
Udu	86.3	64	26.6	5.2	1	1.5	18	6 (9.4)	14.3	1
Waikubukubu	27.5	167	45.5	2.3	3	2	24	4 (2.4)	66.7	1

¹ Korovou, Lutu, Nadala, Udu and Waikubukubu are closer to Tavua Hospital; the rest closer to Suva Hospital.

to cities and towns have any opportunity for this, except perhaps seasonally (for sugar-cane harvesting) in certain areas. Information about education also proved difficult to analyse in terms of peripherality, largely because education (including travel to/from school) is free in Fiji. And mobile phone usage, a common proxy for global connectiveness in comparable contexts, is not used here as phone ownership/usage in these communities appears to be governed largely by both practical considerations (like the availability of line-of-sight signals) and sociocultural ones (like visible device ownership), neither of which bear any relationship to peripherality. Similar conclusions were reached in a comparable study elsewhere in Fiji recently (Nunn & Kumar, 2019).

This section reports the results of this survey by looking at distance and community-size relationships (Section 4.1) and those indicative of community autonomy and resilience (Section 4.2).

4.1. Distance and community-size relationships

While there are other measures of peripherality used to map and analyse location-based data, the use of distance along the sole cross-island road is clearly uncontroversial in the case of Viti Levu Island. This road is almost 200 km long and ascends the steep-sided plateau in the island's north-centre along a series of hairpin loops. Distance is shown in Table 1 and plotted against key variables in Figure 2.

It is no surprise that community size decreases with increasing peripherality (Figure 2A), partly the legacy of a long history of rural depopulation in countries like Fiji but also exacerbated by the often-expressed desire to live in places where there is continuous electricity supply and water on tap, as well as the opportunity to access educational facilities for secondary (high) school children. That said, in rural Fiji, owing to the dominance of communal land ownership, it is often considered important for extended family groups (*mataqali*) to maintain a dwelling in their home communities, to utilise their lands, and participate in communal functions.

Likewise, there is a strong relationship between dependency ratio (the percentage of dependent young/old people) and peripherality (Figure 2A), there being larger proportions of younger/older people in less-peripheral communities. This is a reflection of both community size but also of the availability closer to core areas of better school and health facilities, the latter explaining why elderly residents there may live longer and consequently be proportionately more numerous.

Distance also exhibits comparatively strong negative correlations with the use of the two available health systems: western healthcare represented by hospitals, which are usually accessed for short consultations with medical professionals: and traditional medicine that is available both through the common knowledge of most Fijian adults as well as the broader specialist knowledge of 'traditional healers' who exist in each of the 11 communities studied (see Table 1). As shown in Figure 2B,

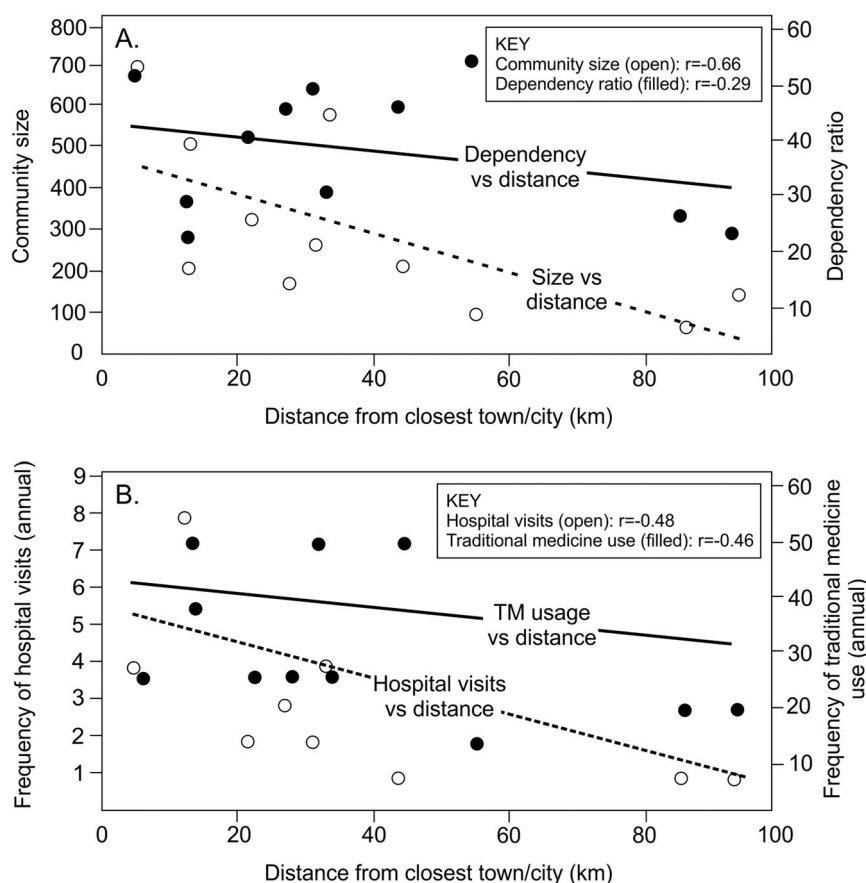


Figure 2. Various data plotted against distance of a particular community from the centres of the closest town/city (either Suva or Tavua – see Figure 1). A: Community size and dependency ratio. B: Frequency of average annual hospital visits and traditional medicine usage.

the frequency of hospital visits is greater by members of those communities that are closer to hospitals (in Nausori, Suva and Tavua) while the use of traditional medicine is proportionately greater in more-distant communities; Figure 2B shows that an average person in a peripheral community who falls sick is more likely to be treated with traditional medicine compared to a person in a near-core community who, while using traditional medicine more often than western medicine, access the latter far more often than someone from a peripheral community. These observations are explainable by the great time/cost for people to access hospitals from peripheral communities compared to those closer. This tendency is amplified by both the comparative lack of cash availability in more peripheral communities as well as the difficulties of travelling along the unsealed part of the cross-island road (Serea-Korovou), parts of which are periodically rendered impassable.

The highest proportions of traditional healers are found in more peripheral communities (Figure 3A); almost one in ten residents of Udu are identified as such. The negative correlation between community size and proportions of traditional healers (Figure 3A) signals the unimportance of critical mass (and underline the role of peripherality) to the existence of traditional healing expertise and to the presence and endurance of traditional knowledge more broadly. This issue is important, not just because it is worth conserving, even strengthening, the practice of traditional medicine in such contexts (DaSilva,

Murukesan, Nandwani, Taylor, & Josekutty, 2004) but also because the future viability of peripheral communities in particular appears to depend on acknowledging and encouraging culturally-grounded aspects of resilience (Maru, Smith, Sparrow, Pinho, & Dube, 2014).

4.2. Relationships indicating community autonomy and resilience

For the communities studied, it is likely that community autonomy – the degree to which a community functions as a self-supporting unit when confronting external challenges – can be measured by both a community's usage and stated preference for traditional medicine and by its ability to recover from disasters largely without outside support. The first measure is calculated from data in Table 1 as the percentage of times that traditional medicine is used to treat ailments (that could also be addressed by a hospital visit) divided by medicine preference. The second measure is calculated by dividing the number of disasters within the past five years from which the community recovered (without outside help) by the use of traditional coping strategies (Figure 4).

For Measure 1, there is a negligible relationship with peripherality (as measured by distance) (Figure 4A) showing no significant difference between communities in any location, something indicating complexities arising from the nature of

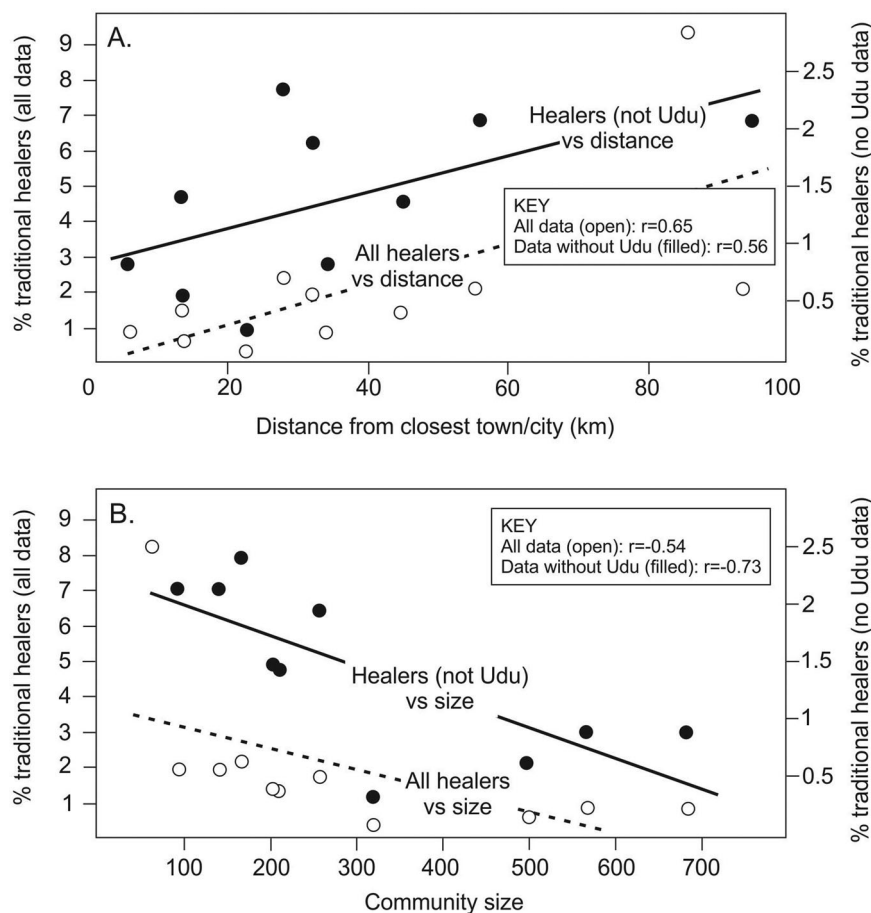


Figure 3. A: Distance from town plotted against percentage of traditional healers with and without data from the community of Udu. B: Community size plotted against percentage of traditional healers with and without data from the community of Udu.

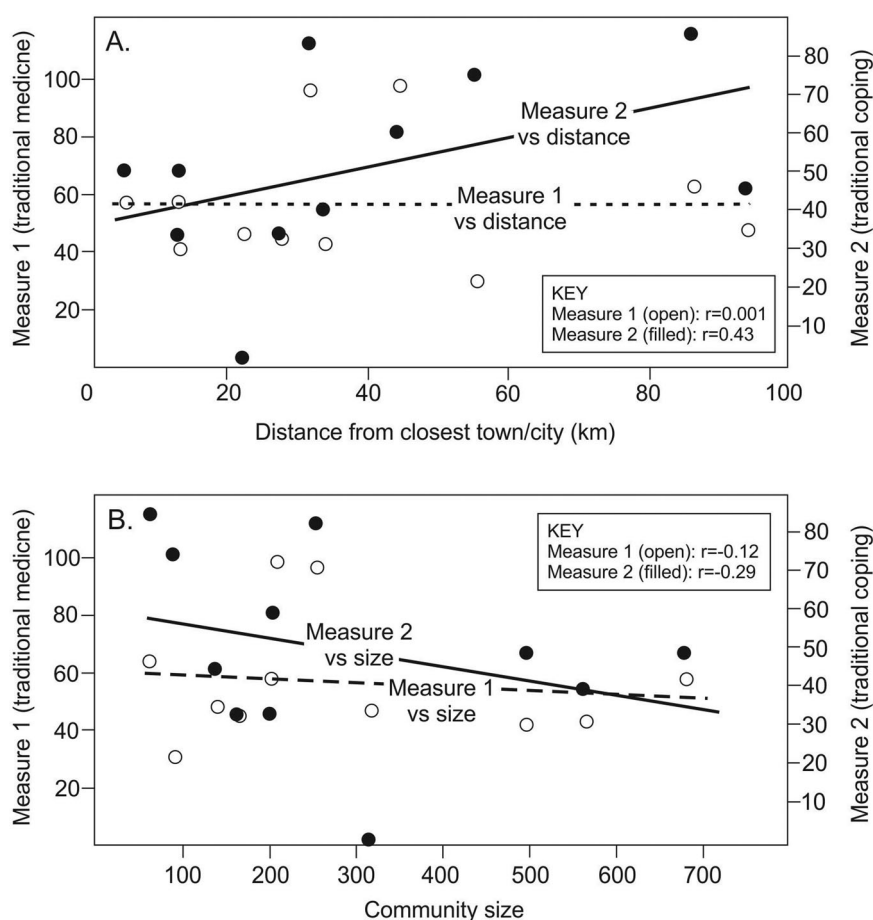


Figure 4. A: Distance from town plotted against Measures 1 and 2. B: Community size plotted against Measures 1 and 2.

treated ailments – trivial ones everywhere treated with traditional remedies, less familiar and/or more serious ones often treated differently depending on location and/or the availability of (appropriately-qualified) traditional healers. Measure 1 also exhibits a very weak relationship with community size (Figure 4B) denoting the existence of similar complexity.

The analyses of Measure 2 are more illuminating. There is a moderate correlation with distance (Figure 4A), demonstrating that traditional coping – arising both from the presence of more traditional knowledge (and knowledgeholders) in the community and from its degree of peripherality that has led to it being forced (in the absence of regular post-disaster assistance) to restore itself – is greater in more peripheral communities. Similar results have been obtained elsewhere (Maru et al., 2014; Nunn & Kumar, 2019) and demonstrate that remoteness does not always equate with elevated vulnerability to environmental stress. There is also a relationship between Measure 2 and community size (Figure 4B), demonstrating that the smaller the community – perhaps because it is less complex/diverse and more coherent – the better it is able to cope autonomously with the effects of disasters; similar results were reported for drought-prone ‘small societies’ (Balbo et al., 2016). Yet given the correlation between peripherality (measured by distance along the road) and community size (see Figure 2A), it is impossible with such a small sample to fully disentangle the relationships exhibited by Measure 2 in Figure 4.

Data collected from the 11 communities, separated for the purpose of this analysis into peripheral and near-core by being either more or less than 32 km from the nearest town allow further insights into the nature of traditional coping (Figure 5). For traditional versus western medicine use, it is clear that the stated preference for one or either (in Table 1) is misleading, given that all communities utilise traditional medicine routinely and sometimes for quite complex ailments. Of the ten most common uses for traditional remedies, the top five (in order, diabetes (*matenisuka*), high blood pressure (*tubunidra*), fever (unspecified), headache, and diarrhoea (*wainicoka*)) are used routinely in all communities (Figure 5A). Diabetes is also the major disease treated using western medicine followed by cancer and high blood pressure (Figure 5B). There is a greater diversity of uses for traditional remedies in more-peripheral communities but otherwise differences with near-core communities in Figure 5A and B can largely be explained by their comparative proximity to hospitals.

Analysis of knowledge of traditional precursors of disaster show that all communities have some degree of culturally-grounded knowledge of these but that this is noticeably more diverse (many more declared precursors) in near-core than in peripheral communities (Figure 5C). The most common precursor is of seabirds unusually seen flying above inland areas, especially forests, for sometimes weeks in advance of a disaster. The second most common precursor is when breadfruit unusually bears more than three fruits on a branch. Other common

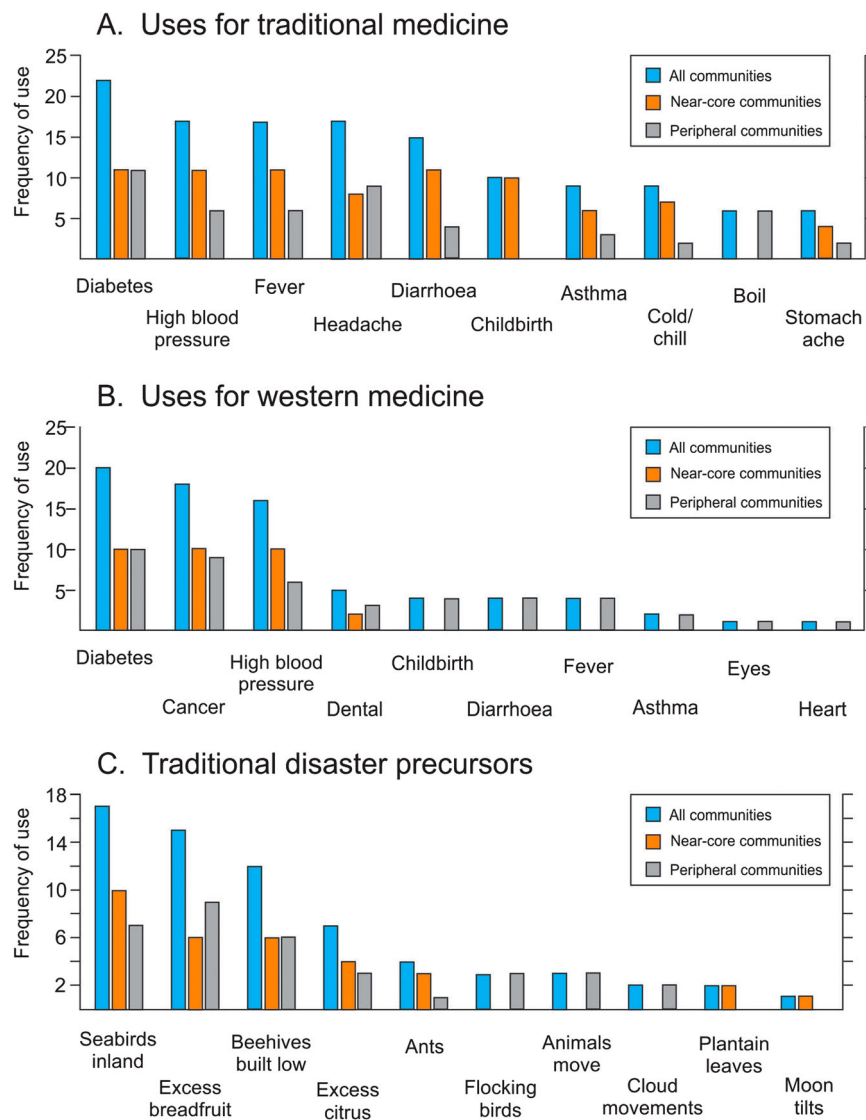


Figure 5. Various data related to autonomous community coping. A: Frequency of use of traditional remedies for various ailments (top ten). B: Frequency of use of western (non-traditional) remedies for various ailments (top ten). C: Frequency of use of traditional disaster precursors (top ten).

precursors include the unusual construction of bee hives in grass or on the lower branches of trees; the excessive fruiting of citrus trees (*moli*); an abundance of ants; the strange flocking behaviour of flying birds; the unprompted inland and upslope movements of wild and domestic animals; rapid cloud movements; and the unusual appearance of the central unfurled leaf (*uvuna*) of the plantain (*vudi*), also noted elsewhere in Fiji (Janif et al., 2016). Among the other precursors is the formation of cirrocumulus clouds, traces of which are sometimes noted weeks in advance of a prolonged storm, named *ketekete-nibici na lomalagi* by people of Waikubukubu, explained as clouds resembling the stomach markings (*ketekete*) of the buff-banded rail (*bici* or *Gallirallus philippensis pelewensis*) in the sky (*lomalagi*); comparable signs are reported from Samoa (Lefale, 2010).

5. Discussion

The degree of peripherality of a community along the cross-island Viti Levu road in Fiji can be linked to community

autonomy, expressed through both the use of traditional medicines and the ability of the community to recover after environmental shocks without external assistance. In the case of traditional medicine usage, it is clear that its proportionality (its comparative frequency of use) can effectively measure peripherality in this situation; the proportion of traditional healers in such communities also appears to be a robust measure of peripherality. In the case of coping (with disasters), it is also clear that traditional knowledge and societal cohesion give more-peripheral communities in the study area the self-belief and ability to recover largely without outside assistance; conversely, near-core communities are generally more dependent on outside assistance in such situations. Both these measures (traditional-medicine usage and traditional-coping ability) can be used as proxies for community autonomy.

Although traditional medicine use is marginally higher in near-core rather than peripheral communities (shown in Figure 2B), the higher use of western healthcare by people in the former shows that the proportional use of traditional medicine is higher in peripheral communities. This inference is consistent

with the higher proportion of traditional healers in these communities (shown in [Figure 3A](#)). Combined with the insight that smaller remoter communities have greater traditional/autonomous coping capacity, it is clear that more peripheral communities exhibit higher degrees of autonomy than near-core communities which are more dependent on national/global networks. While not entirely unexpected, this finding is important in many ways, including for understanding which external interventions for climate-change adaptation are likely to succeed and which are likely to fail in particular communities. Clearly, as anticipated by Nunn and Kumar (2018), interventions requiring an understanding of global climate change/science are more likely to succeed in near-core communities; interventions likeliest to be both effective and sustainable in more peripheral communities are those that acknowledge and build on traditional coping abilities and are culturally-grounded rather than framed solely in global/scientific terms (Nunn et al., 2014).

Comparable examples have been documented elsewhere. In outer-island (peripheral) communities in Micronesia, for example, autonomous coping capacity is greater than among those on core islands (Monnereau & Abraham, 2013) but current climate-change impacts are straining this capacity. In such situations, limits to autonomous coping have become clear, particularly in the aftermath of saltwater inundation (attributable to extreme waves produced by rising sea level). In contrast, peripherality is not the key determinant of coping ability among Jamaican fishing communities where gender and occupation/role are of comparable importance (Baptiste & Kinlocke, 2016). A parallel also exists in responses to climate-associated stressors in Nairobi slums (Thorn, Thornton, & Helfgott, 2015) where (more-peripheral) responses in the poorest areas are autonomous but in other (less-peripheral) areas where residents are more prosperous, responses become more informed (and better-funded) just as they are in near-core settings in island archipelagoes.

The data collected and analysed in this study present some opportunities for climate-change (and other) adaptation strategies to become more successful in the future through being better tailored to the requirements of particular communities along the Viti Levu cross-island road. For example, rather than take a 'one-size-fits-all' approach to these 11 communities, which has been the common default position of many external agencies in such situations in the past (McLeod et al., 2016), it is clear that there is a diversity of community autonomy that does not fit well with such an approach. In fact, should communities with a high degree of culturally-grounded autonomy be given a foreign climate-change intervention, then this might encourage that community to devalue their traditional coping ability: a form of maladaptation, such as happened elsewhere in the southwest Pacific (Fazey et al., 2011).

The specific opportunity with the communities studied is that those more than 32 km from Suva/Tavua demonstrably have autonomous coping abilities that should be harnessed rather than replaced to ensure effective adaptation is sustained. For it seems clear that in many such communities, a respect for western-science informed adaptive solutions is generally sustained only as long as the associated income streams and that, once these dry up, the solutions are abandoned because

the people feel no ownership of them, no desire to sustain them (Nunn, 2009). So for peripheral communities, any intended intervention should first appraise the state of community knowledge, evaluate its efficacy for the purpose of future climate-change adaptation and – acknowledging that this traditional knowledge is key to the sustainability of any intervention – seek to develop it such that it becomes aligned with the best-possible projections for future climate-change in the area; a model process was reported from a remote community in Solomon Islands (Leon et al., 2015). Conversely, near-core (less-peripheral) communities may be considered to have lost most of their traditional coping abilities and would therefore benefit from having globally-informed interventions. This may seem the obvious conclusion although, as discussed below, a more sustainable approach may be to restore their former autonomy rather than cement their dependency. One point of interest is that near-core communities still use – in absolute terms – almost as much traditional medicine as peripheral communities. This is likely to be a function of the larger near-core community sizes and their higher proportions of older people, the usual custodians of traditional knowledge. The inroads made by western healthcare into near-core communities is also clear from [Figure 2B](#).

The data gathered from cross-island Viti Levu communities also allow their needs around climate-change adaptation to be clearly evaluated. With more-peripheral communities where community autonomy is comparatively high, need can be defined only after answering the question of whether traditional coping is adequate for future climate change or not. In most similar cases, the answer is clearly no; future challenges, especially from sea-level rise and more-intense tropical cyclones are unprecedented. In such a case, an understanding has to be reached as to how much (and what kinds of) additional coping capacity is needed by peripheral communities in order to make them optimally resilient to such challenges. With peripheral communities in the interior of Viti Levu Island, for example, this capacity might be reflected in a progressive relocation of settlements from floodplains where they are more vulnerable to unprecedentedly high floods; a parallel study of Biausevu, an interior village in southern Viti Levu, shows that its inhabitants are autonomously abandoning the floodplain, something being achieved by requiring that every newly-wed couple build their dwelling on the slopes above (rather than on) the floodplain, which will see the entire village progressively relocated within a few decades (Campbell, 2006). A similar community ordinance has been issued in Navunievu, a coastal village in western Vanua Levu Island (Fiji) that is experiencing regular inundation during the highest tides as a result of recent sea-level rise (Nunn & Kumar, 2019).

The recent trend, as determined during interactions within these 11 communities, is one of the gradual attrition of traditional knowledge – whether traditional-medicine usage or community coping ability – over time, a trend that might be expected to continue as Fiji becomes ever more part of a globalized world; similar trends have been observed in comparable contexts in the islands of Vanuatu and Solomon Islands (McCarter & Gavin, 2014; Pollard, Thaman, Brodie, & Morrison, 2015). Such a trend towards increasing globalization is

often considered, at least by outsiders, as desirable, one guaranteed to lift people out of poverty and allow them to participate equally in a developed world. While there are many criticisms of this long-standing goal of development *per se* (e.g. Ravuvu, 1988), its desirability in an island context is reduced further when we consider the future.

At present (and for most of the time since independence in 1970), Fiji depends largely on external (aid) funding for many non-revenue-generating activities, including climate-change adaptation. Most bilateral aid donors (including Australia, EU, Japan, New Zealand, USA) have funded climate-change adaptation projects over the past three decades and, more recently, Fiji has enjoyed considerable success in sourcing funds for this purpose from global bodies like the Global Environment Facility (GEF). Like many Pacific Island Countries, Fiji has become dependent on external funds for climate-change adaptation and mitigation, benefitting from being on the 'frontline' of climate change with many visible impacts compared to most larger countries (Brown, Daigneault, & Gawith, 2017; McNamara & Jacot des Combes, 2015; Mimura & Nunn, 1998). Yet, as the pace of climate change increases over the next few decades, adaptation costs in donor countries will soar and the money available to support countries like Fiji for adaptation will likely decline. With this situation in mind, we question whether the trend towards increasing globalization in communities such as those studied is the one likeliest to sustain the livelihoods of their inhabitants or not.

If aid funds for climate-change adaptation (and environmental management more broadly) decline in future while costs increase, then the Fiji Government will inevitably have to spend more of its own revenue on this. There are unlikely to be sufficient funds available, so priority will likely be given to those demands considered most urgent, probably the protection/relocation of (the densest-populated) coastal settlements/towns/cities and (most valued) infrastructure likely to be overwhelmed by accelerating sea-level rise (Nerem et al., 2018). Helping other rural communities, such as those on outer islands and in the interior of the larger islands (like Viti Levu), is likely to become a low priority. In anticipation of this, such communities will likely have to adapt (largely) autonomously, a process requiring their ownership of adaptive solutions (Nunn, 2009; Nunn & Kumar, 2018). While there are other possibilities, it is here argued that the best way of assuring this is to reverse current trends and encourage rural communities to conserve, re-discover, sustain and utilize that traditional knowledge which allowed their forebears to survive through millennia of environmental adversity (McNeill, 1994; Nunn, 2007). Parallel calls for re-embedding traditional environmental knowledge into adaptive practice come from Africa and the Philippines (Galacgac & Balisacan, 2009; Makondo & Thomas, 2018).

In terms of resilience and vulnerability, it is clear that most elements that supported the resilience of global communities in pre-globalization Fiji still exist in more peripheral communities. This traditional resilience is being progressively eroded in near-core communities. In anticipation of a future when developing countries like Fiji will be unable to afford/obtain global solutions as readily as they do now, it appears sensible

to document and conserve key elements of traditional coping in peripheral communities and to incentivize the uptake of these by other communities.

In practical terms, re-building traditional coping capacity in such communities first requires the issue of privileging to be addressed. Most aid donors and Pacific Island governments privilege western/global science and secular solutions whereas traditional coping privileges local, culturally-grounded knowledge that may be largely spiritually contextualized. The precise nature of how adaptive solutions which privilege this kind of thinking yet acknowledge global understanding of unprecedented future climate change is beyond the scope of this paper but has been addressed in other studies in the Pacific Islands and elsewhere (Cronin et al., 2004; Dumar, 2010; Lebel, 2013; Mercer, Dominey-Howes, Kelman, & Lloyd, 2007; Warrick, Aalbersberg, Dumar, McNaught, & Teperman, 2017).

6. Conclusions

The pace of climate change is accelerating and its impacts consequently increasing. In island nations of the western Pacific, sea level is rising at rates currently 2–4 times faster than the global mean, causing disproportionately greater impacts than along most of the world's coasts (Albert et al., 2016; Becker et al., 2012; Nunn, Kohler, & Kumar, 2017). Such changes underscore the growing need for effective and sustainable adaptation, especially among those rural communities occupying islands on the 'climate-change frontline'.

Effective adaptation requires that solutions actually address the priorities of the people threatened by climate change, especially with regards to their (subsistence) livelihoods. Sustainable adaptation requires that effective solutions are 'owned' by key community-based stakeholders who undertake to sustain them. Many past interventions in the Pacific Islands have neither been effective – often they address only donor priorities – nor been sustainable because they were developed and implemented without (adequate) community-level consultation and/or in ignorance of relevant traditional knowledge (Nunn, 2009; Nunn & Kumar, 2018). Similar conclusions have been reached for comparable contexts elsewhere (Baudoin & Ziervogel, 2017).

Given the likelihood that the growing costs of climate-change adaptation in the future in countries like Fiji will be funded with increasing inadequacy, it seems that any initiatives which strengthen the autonomous capacity of rural communities to cope with likely climate-change impacts are important to encourage. Arising from our study of 11 communities in the interior of Viti Levu Island, we identify the conservation (and re-distribution) of traditional knowledge as key to effective and sustainable adaptation.

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