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Responding to multiple climate-linked stressors in a remote island context: The example of Yadua Island, Fiji

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ABSTRACT

Island societies are being disproportionately affected by climate change, a situation likely to continue for some decades. Using an example of an island affected by multiple climate-linked stressors, a situation likely to become more common in the future, this paper examines the nature of these, the ways they are perceived and responded to by local residents, and how these people believe environmental changes might unfold in the future. Yadua Island has one settlement (Denimanu), where most of the 170 residents sustain themselves largely by fishing and farming. Like most Pacific Island settlements, Denimanu is coastal and has experienced progressive shoreline erosion that, a decade ago, washed away a row of houses. In 2012, a storm surge (during Tropical Cyclone Evan) demolished most of the remaining *bure* (traditional dwellings) in the village. The Fiji Government relocated the affected families to a new upslope location (Korovou), 80–230 m from the beach, and up to 20 m above mean sea level. In March 2017, heavy rain caused a landslide at the back of Denimanu that endangered the primary school, forcing its abandonment. Some questionnaires were given to representative members of the community in an attempt to understand and quantify the pressures that Yadua Island people are subject to, and how they plan to manage them. All respondents believed that climate change has affected their livelihoods and will continue to do so in the future. Clear majorities stated that climate change – especially higher temperatures and increased frequency/magnitudes of heavy-rain events – had negatively affected the supply of marine and terrestrial foods. Most respondents noted increased temperature and decreased precipitation. Clear majorities stated they would eventually relocate their homes further inland, and would consider planting mangroves. Most participants were contemplating the effects of climate change (especially sea-level rise) on food supply, prompting them to consider relocating lowland crop production further inland and planting crops that are more tolerant of saline groundwater and/or periodic wave over-wash. The people of Denimanu recognise how the environment has been changing but debate the ultimate cause of this and therefore how best to respond. It is likely that Yadua will become impacted more by tropical cyclones and sea-level rise (in particular) in the future. To be effective and sustainable, adaptation strategies should acknowledge residents' worldviews and beliefs rather than try to uncritically substitute them.

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1. Introduction

Climate change is the principal expression of a naturally occurring cycle manifested as the alternation between major ice ages and interglacial periods. Yet since the early 20th century, a near-unanimous scientific consensus agrees that anthropogenically-generated greenhouse gas emissions are warming the Earth's climate. Climate changes observed since the 1950s have been recognised as unprecedented and likely to continue into the foreseeable future (IPCC, 2014). The rate of sea-level rise is projected to keep increasing with continued global warming and, even if greenhouse gas emissions are stopped and temperatures stabilise, sea level is expected to continue rising for centuries (Mengel et al., 2016). Human societies are vulnerable to climate change and the risks it poses. Climate change may exacerbate ongoing social and economic challenges, particularly in those parts of the world where societies depend closely on natural resources (Adger et al., 2013).

Oceanic-island societies experience similar pressures to continental societies but their vulnerability is exacerbated by comparatively limited physical space, high insularity ratios, exposure to natural hazards, small watersheds, limited terrestrial biodiversity, narrow range of land resources, and often limited funds and human capacity for addressing livelihood challenges (Albert et al., 2016; Albert et al., 2017; Briguglio, 2003; Nunn, 2009b; Wong, 2011). Additionally, islands are often comparatively highly exposed to feedback effects between society and environment (Bunce et al., 2009; Nunn and Kumar, 2017). Using the example of a comparatively remote and resource-constrained community, this paper looks at how a typical island society has been affected by and has responded to multiple climate-linked stressors. This example is considered a glimpse into a situation that is likely to become more common in the future – and is therefore instructive to those seeking to manage the associated climate risks effectively and sustainably.

1.1. Tropical Pacific islands and climate change

Small Island Developing States (SIDS) located in the tropics, such as the Fiji Islands, are exposed to cyclones and damaging winds, tsunamis and coastal floods, each of which has the potential to severely impact the local economy (subsistence and commercial), residential and agricultural areas, transport and communication services, and cause injuries or death to large numbers of people (Lau et al., 2017; Weir and Virani, 2011). In tropical Pacific SIDS, most people live in rural areas and depend largely on their local environments – marine and terrestrial – for foods they consume routinely. Although Fiji has an uncommonly high degree of urbanization compared to other Pacific SIDS, its rural coastal communities are typical of thousands throughout the tropical Pacific islands that are already feeling some effects of rising sea level and are expected to be more profoundly impacted by this in the next 20–30 years (Lata and Nunn, 2012; McNamara and Des Combes, 2015; Moceituba and Tsang, 2015).

The ocean around Fiji's islands has been rising at about 5.5 mm/year since 1992, almost twice the global average (Friel et al., 2011; Wairiu et al., 2012). Sea-level rise has caused widespread shoreline erosion, groundwater salinization and has increased the incidence and magnitude of coastal flooding (Woodruff et al., 2013). Compared to the 1985–2005 average, models project that sea level around Fiji will have risen by 8–18 cm by the year 2030 and 41–88 cm by the year 2090 (Church et al., 2013). Other modelling approaches suggest sea level by the end of this century may be almost 200 cm higher (Jevrejeva et al., 2014). Whatever scenario is adopted, it seems inevitable that sea-level rise in Fiji will accelerate over the next few decades, posing increasing challenges for those people living along island coasts, as well as the activities they pursue there.

In many coastal areas around the world, there is a significant gap between scientifically-determined risk and perceived risk (Mills et al., 2016). This gap, in Fiji and elsewhere, frustrates the development of effective and sustainable adaptation strategies for climate change. It has also been attributed to a lack of awareness about both the nature of scientific projections and their localization, as well as cultural controls on the perception of risk (Johnston, 2014; Lata and Nunn, 2012). The latter includes short-term planning perspectives, spiritual beliefs, and traditional governance structures. For example, in the Rewa River Delta (southeast Viti Levu Island, Fiji), questioning of local residents revealed that while few people knew about climate change and what caused it, many recognized the current nature of its (anomalous) manifestations, particularly more frequent flooding and progressive groundwater salinization (Lata and Nunn, 2012). Further, as in many traditionally communal subsistence societies, individual actions and beliefs are commonly subordinated to community leaders (in Fiji, these include hereditary chiefs and spiritual leaders) so that communal decision-making is often slow to catch up with contemporary (scientific) understanding of observed environmental changes and how best to respond to these (Nunn, 2009a).

Extreme weather events affect Fiji regularly. Natural disasters such as cyclones, floods, 'king' tides, earthquakes, tsunamis and droughts regularly impact the major socio-economic sectors and consequently affect the quality of life of many rural communities (McNamara and Prasad, 2014). Yet these communities have a long tradition of implementing strategies to cope with extreme weather, such as particular planting techniques and innovative water storage and food preservation practices. Local experiences and knowledge have proved essential for sustaining Fiji's communities for three millennia. Today, with the growing threats of climate change, they remain important for community-based responses to extreme weather events, something that may be important when outside help, particularly in the aftermath of natural disasters, proves sometimes unreliable or too slow (Johnston, 2014; McNamara and Prasad, 2014).

2. Yadua Island, Fiji, and its climate-linked stressors

Comprising over 300 habitable islands, of which about 70 are permanently occupied today, the Fiji Islands are located in the Southwest Pacific Ocean (Fig. 1). Most of the nearly 900,000 people live on the two largest islands – Viti Levu and Vanua Levu –

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