A narrative review of the health impact of climate change and food security on Pacific Island countries and territories

Thomas Swinburn, Vili Nosa, Judith McCool

Abstract

INTRODUCTION
Pacific Island countries and territories (PICTs) are experiencing the effects of climate change. A changing climate threatens regional food security. This has implications for the way food is sourced and consumed, and in turn, the health challenges PICTs face. This paper presents a narrative analysis of accessible literature from PICTs on the health impacts of climate change and food security.

METHODS
The MEDLINE and Scopus databases were used to identify relevant literature, with no date restriction. Records were organised using a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. Ten articles, published between 2010 and 2019, were included in the final synthesis. Included articles were those that explored the convergent themes on the described association between climate change, food security, and health.

RESULTS
Four articles examined the wider Pacific region, four referred to the Micronesia region and/or its constituent countries, and two focused at the country level. Various social, cultural, and economic factors may explain why food security has been worsening over time, coinciding with shifts in dietary patterns, and in turn, health challenges.

DISCUSSION
Climate change is impacting food security through its effects on fisheries, agriculture, and migration. These shifts are documented in various studies based within PICTs, yet there are relatively few studies drawing together climate change and food security with a view to informing public health interventions.

CONCLUSION
Food security remains a major public health issue for PICTs, and further research is needed to support the development of evidence-based public health policy responses to the climate change impacts on health in the region.

Introduction
Climate change presents significant implications for all forms of life.1 Rising sea levels, changes to the temperature of both the atmosphere and the ocean, and meteorological changes are among the most penetrating impacts. Climate change is having, and will continue to have, an environmental, sociocultural, and economic impact on Pacific Island countries and territories (PICTs), which share an experience of the vulnerabilities that come with being small, developing, island states within a vast oceanic space — and with increasing demands on limited resources. In the immediate future, extreme weather events present disruptions to, and challenges for, everyday living and livelihoods. Should the long-term predictions continue to unfold, island communities will need to adapt and live differently from how they do currently.

Amongst the many impacts of a changing climate is the threat to food security.2 Food security is the ability to access a safe and nutritious source of food at all times, which is sufficient for maintaining health and wellbeing.3 In this way, food security is typically assessed according to the following three parameters: firstly, “food availability” is the consistent and sustainable presence of a sufficient quantity of food; secondly, “food accessibility” refers to whether people are able to acquire enough food through a transaction or process; thirdly, “food utilisation” refers to whether the food is stored, cooked, and consumed safely in a way which provides nutrition.4

Changing food security environments are anticipated to impact the health challenges PICTs face. For instance, amongst the impacts of climate change, the loss of land and traditional ways of sourcing food may lead to situations of increasing food insecurity. This may require increasing reliance on food imports, further entrenching changes to traditional diets. Diet-related health impacts are well documented, including the global trend towards increased prevalence of obesity, diabetes, cardiovascular disease (CVD), cancers, and other impacts of malnutrition in all its forms.4 This could in turn adversely impact the health of the population through an increased incidence of diet-related non-communicable diseases (NCDs).4

This paper presents a narrative literature review of the health impact of climate change and food security in PICTs.

Methods
The MEDLINE and Scopus databases were interrogated to identify relevant literature. Search terms combined ‘Pacific’ and a list of PICTs, ‘climate change’, and ‘food security’, along with appropriate synonyms. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework was used to organise the literature search strategy (Figure 1).

From the results, duplicates were removed before screening by title and abstract. Included records were those in the English language which considered all four themes, with no date restriction. In terms of assessing relevance to the Pacific, articles needed to consider either the Pacific region as a whole, a subset of this region (e.g. Melanesia), or a specific PICT. Articles with primarily biological, geo-ecological,
meteorological, or agricultural themes were excluded. Following screening, 19 full-text articles were assessed for eligibility, with nine subsequently removed. The principal reasons for exclusion were a lack of relevant coverage on food security, and articles which, despite the title, did not focus on the Pacific region. In this way, ten articles were included in the final synthesis (Table 1).

**Results**

Of the ten articles included in the final synthesis, four considered the entire Pacific region, and four referred to Micronesia or its constituent countries, and two referenced other specific Pacific countries. Three articles reviewed the literature to specifically examine the link between climate change, food security and health. Others generally described trends in food security, the potential impact of climate change, and possible solutions. The remaining articles considered sea level rise and ciguatera. Figure 2 summarises the key findings.

**CHANGING FOOD SECURITY AND HEALTH IMPLICATIONS**

Historically, a variety of Indigenous practices maintained food security, including surplus production, famine crops, intra- and inter-community exchange networks, and crop diversity. It appears to be accepted that food security has typically been worsening over time, coinciding with shifts in dietary patterns. The literature identifies a plethora of contributing and interacting factors, which include a shift away from traditional agriculture and fishing practices, and cultural changes concerning food preferences and perceptions. Various economic drivers were identified, such as the establishment of commercial crops, the increasing influence of international markets, and globalisation. Historical and social phenomena, including colonisation, migration, urbanisation, population growth, and poverty were also explored. Overall food production decline and health literacy issues were also discussed as contributing factors.

There appears to be a consensus that these dietary changes associated with situations of increasing food insecurity can be characterised by reduced dietary diversity and increasing consumption of low quality, energy dense food of poor nutritional value, typified by that of imports. Some scholars classify these changes as an example of the “nutrition transition”. There are a number of studies that make a strong association between these changes and the burgeoning incidence of NCD and their risk factors. These include overweight and obesity, hypertension and CVD; micronutrient deficiencies; and nutrition problems, including stunting, diabetes, and anaemia. Schubert and Savage note that many communities face the challenge of co-existing, juxtaposed issues of both under- and over-nutrition. Ahlgren points out that in the Marshall Islands, a complex syndemic of risk factors are producing diet-related NCD alongside communicable diseases such as tuberculosis. Furthermore, water- and vector-borne infectious diseases were noted as challenges, with the possibility of secondary malnutrition compromising food security.

**CLIMATE CHANGE AND FOOD SECURITY**

The acute vulnerability of the Pacific Island region is increasingly recognised. There is recognition that climate change acts both as a direct and indirect risk multiplier, magnifying a background of existing challenges. The literature cautiously reports that climate change is likely to exacerbate existing challenges in situations where food security is becoming increasingly precarious as a result of many of the reasons previously described. Explanation of these mechanisms tend to revolve around the impact of climate change on fisheries and agriculture, livelihoods and migration, disaster response, and infectious diseases. Barnett incorporates a slightly broader position, noting that climate change may ultimately impact food production, economic growth, poverty, and health to influence food security, relating wider concepts such as tourism. Overall, the evidence suggests that, much like the contemporary situation, reliance on imported foods will continue, or indeed increase, associated with under- and over-nutrition, and diet-related NCD. Savage and Cauchi acknowledge that the evidence in the Pacific linking climate change, food security, and health outcomes is not yet robust. Difficulties arise due to the array of related, yet distinct, socio-economic factors; for instance, urbanisation. Furthermore, delineating the temporal delay between the onset and tangible manifestation of both climate change and health conditions presents a further methodological challenge.

Alongside a general Pacific-wide decline in agricultural production, the impact of climate change presents distinct challenges to local food production. Emerging issues for agriculture include the threat posed by extreme weather events in the short term; the emergence of pests and diseases, and threat to livelihoods; and the risk to supporting infrastructure.

Fisheries are fundamental for subsistence and income in the Pacific. To date, the evidence of the effects of climate change is less well-established for fishing than for agriculture. Evidence suggests that increasing extreme weather events, alongside changes in oceanic composition, temperature, and currents, may adversely affect fish availability, contributing to food insecurity. Barnett takes a slightly contrary position, suggesting that the effect on small scale fisheries, the lifeline of many communities, is uncertain. However, increased variability in catches at a commercial level could have economic consequences. One recurrent theme in fisheries was the resurgence of ciguatera fish poisoning, a non-specific illness which occurs when ciguatoxins are transmitted through the food web to humans. It has been speculated that the recent expansion in the geographical incidence of the disease may be associated with rising sea temperatures, which has direct food security and health implications.

Climate change-related migration is real, and has both social and ecological drivers, as discussed. Savage makes an interesting point, suggesting that food insecurity is likely to be both a cause and a consequence of climate migration. Furthermore, Savage questions whether existing relocations observed can be definitively linked to climate change, pointing out that the links with food security and health outcomes remain theoretical. Nonetheless, evidence supports the position that migrants moving from traditional lands to increasingly urbanised areas tend to find themselves in positions of decreased food security, which engenders many of the dietary and lifestyle changes associated with diet-related NCD.

There is growing support for the position that the current humanitarian aid response to disasters, whilst ensuring short-term food security, may paradoxically destabilise long-term food security by making traditional coping strategies redundant. Savage notes that these associations require further research. Furthermore, water- and vector-borne infectious diseases were noted as challenges, with the possibility of secondary malnutrition compromising food security.

In the face of these interrelated challenges, whilst several papers mentioned policies, principles, and solutions, studies documenting successful adaptation or mitigation interventions remain sparse.

Cauchi cites trust and governance issues as factors hampering progress. In spite of this, principles for combating these issues point towards multidisciplinary collaboration at all levels, placing Indigenous practices at the heart of policies and projects, and taking a broad, integrative, “health in all policies” approach.

**Discussion**

This review accessed peer-reviewed literature on climate change and food security in the Pacific Island region. An important objective of this review was to assess the nature of the current literature, evaluating where our current understanding is sitting in regard to these complex, interrelating topics. It has become clear that the literature is in an early, descriptive, and even cautious stage, with many key authors in the field noting the difficulty in making definitive links between climate change, food security, and health outcomes.

It is important to note the limitations of this review. The selection
of the sample was based on a pre-defined search strategy of a series of databases. This meant that only peer-reviewed literature was included in the analysis. This decision means that technical reports or other commentaries published by governments or non-governmental organisations in the grey literature domain were not accessed. Furthermore, research and commentary on the public health response to climate and food security policies were not identified in our search. This is an area for future consideration, given the importance of public health preparedness in this area. Finally, our results identified that the majority of studies focused on the Micronesian region. This outcome may reflect the greater emphasis on food security, given the unique geography of Melanesia and some parts of Polynesia.

Further research into culturally- and context-appropriate policies, strategies, and solutions is needed, as well as how communities interpret their experiences of climate change on food security and health. Future research will be needed to better understand, and respond effectively to, the vast, interwoven challenges climate change presents and signifies. These include the methodological challenges in the attribution of observed phenomena, such as migration, to climate change, and how these interact with interrelated drivers, such as socio-economic, commercial, and political determinants. Furthermore, distinguishing between anthropogenic-induced climate change and environmental and ecological shifts warrants and receives ongoing investigation. Research also relies on relatively imprecise climate change prediction modelling, as well as temporal variables that influence cause and effect. Perhaps it is for some of these reasons that literature linking all three concepts (climate change, food security, and health) within the context of the Pacific was relatively sparse, and primary data studies were even more scant. Research into adaptation strategies is also in an early stage. Hydroponic gardening and transplanting crops that are typically endemic in hotter climates, such as those of Africa and Asia, may be possible agricultural adaptation strategies for PICTs, and the viability of these novel methods warrants investigation.15

Climate migration was raised a number of times in the literature, yet it is among the most poorly understood themes, compared with ones such as agriculture and fisheries. It would be valuable to address the lack of work focusing “closer to home” in Polynesia. Understanding how migration may change in the future in response to climate change could be important in shaping immigration policy, regional security responses, and general preparedness, especially given New Zealand’s standing as an influential and affluent, Polynesian country. The contemporary examples of Kiribati’s purchase of land in Fiji, and more recently, the landmark United Nations court case in New Zealand of climate refugee Ioane Teitiota, highlight the need for research and discourse, now, and most certainly into the future, as a means to guide decision making. Similarly, issues around humanitarian relief were raised which, with further research, could influence New Zealand’s aid agenda.

The PICTs are facing the interrelated challenges of climate change, food security, and health in the here-and-now. As an affluent and influential Pacific Island, New Zealand has an important role to play on several fronts. New Zealand needs to remain a clear and committed ally to our Pacific neighbours – this may be challenging to New Zealand sovereignty when issues of trade are at stake.16,17 However, a prosperous, secure, and healthy Pacific has collective benefits. Medical students are not only the future health workforce, but they are the future spokespersons for collective action on issues that impact on population health. Access to healthy food is one of the fundamental human rights – and one that needs our collective protection, from advocacy on reducing carbon emissions, to trade agreements that prioritise public health.

Conclusion

Our analyses of published literature on climate change, food security, and health outcomes specific to PICTs identified that climate change acts as an indirect driver to exacerbate existing food security challenges in the region. Food insecurity will remain a major public health issue for the region unless measures are taken to protect and adapt local food systems. Further research is needed to support the development of evidence-based public health policy responses to the climate change impacts on health in the region.

Figure 1. Literature search strategy
Table 1: Climate change and food security in Pacific Island countries and territories

<table>
<thead>
<tr>
<th>Title</th>
<th>Date</th>
<th>Country/Region</th>
<th>Author</th>
<th>Type of paper</th>
<th>Aim</th>
<th>Key Findings</th>
</tr>
</thead>
</table>
| Review: the nexus of climate change, food and nutrition security and diet-related NCDs in Pacific Island countries and territories | 2019 | Pacific region | Amy Savage, Lachlan McIver, Lisa Schubert | Literature review | Investigate the links between climate change, food security and NCDs in support of a ‘health in all policies’ agenda. | Four key themes were identified:  
> Climate change events, and particularly extreme weather events in the short term, will have adverse impacts on agriculture, with a potential for a reduction in food availability and dietary quality.  
> Current pressures on fish and their ecological habitat will be exacerbated by climate change, and food availability in reef fish is unlikely to be adequate to meet requirements.  
> Climate change migration may serve as both a driver and consequence of food insecurity, while urban migrants typically have reduced food security.  
> Disaster relief may destabilise long-term food security.  

The impacts through these four pathways may maintain the reliance on imported foods, which will likely increase the burden of diet-related NCDs. |

| Small island developing states, climate change and food and nutrition security | 2017 | Pacific region | Lisa Schubert, Wendy Foley, Amy Savage, Grace Muriuki | Literature Review | Describe the mechanisms linking climate change and food security, the impact, and possible adaptive strategies. | Climate change may impact food security by:  
> Impinging on livelihoods, affecting food production systems and income, leading to reduced dietary diversity and food security.  
> Engendering migration, altering lifestyles and diets.  
> Increasing food dependency for nutrient-poor diets.  
> Disrupting food markets, resulting in poorer quality food with less availability but increased expense.  
> Increasing infectious diseases, which risks secondary malnutrition and increases morbidity and mortality in vulnerable populations. |
Development, global change and traditional food security in Pacific Island countries

2014 Pacific region John Richard Campbell Discussion article Describe traditional ways of ensuring food security, and discuss how these practices have changed with colonisation and globalisation, and possible ways in which food security might be strengthened.

Traditional practices such as surplus production, agricultural diversity, famine foods, and community networks maintained high levels of food security. In recent times, colonisation, commercialisation of crops, socio-economic changes such as migration, and disaster response have decreased food security, leading to increasing food dependency. Revitalising old ways of ensuring resilience and building strong transnational relationships may be ways to ensure food security in the face of climate change.

Dangerous climate change in the Pacific Islands: food production and food security

2010 Pacific region Jon Barnett Discussion article Discuss the impact climate change will have on food production and security in order to determine whether climate change can be considered a threat.

Climate change is likely to reduce agricultural production through its detrimental effects on crops and infrastructure. Dependency on imports and a drive towards monocultural crops further increases vulnerability to climate change. Fisheries are equally likely to experience increased variability in catches, which has implications for subsistence and income. The combined effects of reduced food availability and ability to purchase food, and health impacts, suggest climate change could be dangerous to food security in the region.

Food security in the island Pacific: Is Micronesia as far away as ever?

2015 Micronesia John Connell Discussion article Describe trends and changes in food security in the Micronesian Pacific, including the impact on health and threat of climate change.

Declines in agriculture, fishing, and local food production as well as wider social, economic, and cultural changes have led to declining food security and an increased reliance on imported food. Resulting changes in nutrition are associated with micronutrient deficiencies and diet-related NCDs. Climate change is likely to continue to impact agriculture, fisheries, and migration, increasing dependence on imported foods.

Climate change, food security and health in Kiribati: a narrative review of the literature

2019 Kiribati John P Cauchi, Ignacio Correa-Velez, Hilary Bambrick Narrative Review Examine the link between climate change and health via the indirect pathway of food security.

Four key themes were identified:
- Kiribati is highly vulnerable to climate change owing to social and ecological factors.
- Kiribati has been undergoing a nutrition transition, leading to dependence on imports, and subsequently, micronutrient deficiencies and NCDs.
- Governance and capacity issues hamper the addressing of climate change and food security challenges.
- Traditional knowledge will be important in ensuring a return to food security.
<table>
<thead>
<tr>
<th>Title</th>
<th>Year</th>
<th>Location</th>
<th>Authors</th>
<th>Article Type</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rising oceans, climate change, food aid, and human rights in the Marshall Islands</td>
<td>2014</td>
<td>Marshall Islands</td>
<td>Ingrid Ahlgren, Seiji Yamada, Allen Wong</td>
<td>Discussion article</td>
<td>Discuss the rights of Marshallese to good nutrition, whilst considering how this might be impacted by climate change. Historical events have created a situation of increasing dependency on imported foods and changing cultural preferences, with negative health implications. Food aid may provide short-term food security, but can destabilise long-term food security. It is likely climate change will have an adverse impact on food systems, maintaining dependency on food aid. Combined with migration, this may exacerbate existing syndemics of NCDs and CDs in the Marshall Islands. Policy changes are needed to ensure adequate nutrition for the Marshallese population, including examining the nutritional content of food aid.</td>
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<tr>
<td>Sea-level-rise disaster in Micronesia: sentinel event for climate change</td>
<td>2010</td>
<td>Federated States of Micronesia</td>
<td>Mark E Keim</td>
<td>Original study</td>
<td>Describe the impact of an acute sea level rise on two populations living on atolls. An acute sea level rise resulted in infrastructure damage, significant food losses, and water and sanitation degradation, with long-standing, devastating effects for food security.</td>
</tr>
<tr>
<td>Ciguatera poisoning in French Polynesia: insights into the novel trends of an ancient disease</td>
<td>2019</td>
<td>French Polynesia</td>
<td>M Chinain, C M Gatti, M Roué, H T Darius</td>
<td>Mini review</td>
<td>Describe the clinical manifestations of ciguatera, its causative pathway, and its increasing geographical spread in the Pacific. Ciguatera is a seafood poisoning which results when humans ingest marine products with a sufficiently high concentration of ciguatoxins, jeopardising reef fish as a subsistence resource and hence threatening food security. Climate change is the likely reason why this disease is expanding geographically, illustrated by the outbreak in a previously unaffected region of French Polynesia.</td>
</tr>
<tr>
<td>Neo-traditional approaches for ensuring food security in Fiji Islands</td>
<td>2018</td>
<td>Fiji</td>
<td>Shipra Shah, Asinate Moro, Jahangeer A. Bhat</td>
<td>Discussion article</td>
<td>Discuss traditional knowledge systems, changes, and the current food security situation, and the possibility of a neo-traditional approach to farming. Traditional knowledge systems which ensured food security have progressively been eroded by social and economic changes, which has impacted food security, leading to a situation of dependence on imported foods, and in turn, NCDs. Climate change may further expose these vulnerabilities. Combining contemporary knowledge with traditional practices may offer a way to food security.</td>
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NCDs: non-communicable diseases
CDs: communicable diseases
References


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