Food security in the Southwest Pacific

R Michael Bourke, The Australian National University

Improvements in food security

Over the last 80–140 years food security has increased across the Southwest Pacific countries, in particular in Papua New Guinea, Vanuatu and the Solomon Islands where between 76 and 87 per cent of the populations live in rural areas. Food security, as defined by the United Nations' Committee on World Food Security, means that all people at all times have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life (IFPRI 2020).

Food security has increased in the Southwest Pacific nations because of:

- the adoption of more hardy and productive food crops including sweet potatoes, cassava, tannia (*Xanthasoma taro*), maize, African yam, peanuts, numerous vegetables including pumpkin, choko, amaranths and hardier cultivars of existing crops, particularly ABB triploid banana;
- the use of cash to purchase food when subsistence food is insufficient; and
- links between urban and rural relatives.

Adoption of new food crops

The adoption of new food crops has varied between locations and over time. For example, the anthropologist Malinowski (1935:180) noted that sweet potato was adopted on Kiriwina Island in the Trobriands around 1890 and was a moderately important crop by 1915 by which time its incorporation into gardens had helped reduce the impact of food shortages. When taro blight, a deadly disease caused by the fungus *Phytopthora colocasiae*, resulted in the destruction of taro crops in Solomon Islands, Bougainville and Buka in the 1940s (Packard 1975), sweet potato rapidly replaced it as the staple food (Connell 1978). By the early to mid-2000s, sweet potato provided about 65 per cent of food energy in Kiriwina, PNG and Solomon Islands (Bourke et al. 2006:23). Production and consumption of sweet potato continues to expand in PNG and Vanuatu, as it does elsewhere in the Pacific islands (Iese et al. 2018).

In recent decades, villagers in many locations in the SW Pacific have grown more cassava, although it has become the most important food in only a few locations. Over the past 30 years, African yam has been incorporated into food production systems in the region, along with triploid bananas, particularly hardy ABB types, that are high yielding and resistant to drought.

These newly adopted food crops have increased food security in a number of ways. They generally produce more food per unit of land area than the older Asia-Pacific food crops such as taro, yam and diploid bananas. Importantly, they continue to produce reasonably well when land use is intensified and soil fertility declines. Newly adopted food crops can increase total food production because the cropping period can be extended and fallow periods can be reduced allowing more numerous plantings over a 15–20 year period. Improvements in food security associated with changes in staple food crops have mostly occurred in the PNG lowlands, intermediate altitude zones, as well as in the islands of PNG, Solomon Islands and Vanuatu. There have been some gains in productivity with adoption of different foods crops in the PNG highlands, particularly cassava and triploid bananas in the lower valleys, and 'English' potato at higher altitudes (2000–2800m). However, there have been fewer gains from adoption of new species in the PNG highlands than in the lowlands and islands in the region. Table 1 gives an overview of the main food sources in PNG, Solomon Islands and Vanuatu.

Table 1. National population and food sources in Papua New Guinea, Solomon Islands and Vanuatu

Parameter	PNG	Solomon Islands	Vanuatu
Estimated mid-2020 national population (1)	8,935,000	712,000	295,000
Rural dwellers as proportion of total population (per cent) (2)	87	80	76
Proportion of food produced locally (per cent) (3)	83	79	78
Main sources of carbohydrate food from locally produced sources (4)	Sweet potato, banana, coconut, yam, cassava, sago, taro, tannia	Sweet potato, coconut, cassava, banana, tannia, taro, yam	Taro, coconut, banana, yam, cassava, tannia, sweet potato

Notes

1. (Pacific Community 2020). The population of PNG is not known precisely as there has not been a reliable national census since 2000. Bourke and Allen (forthcoming) estimate the mid-2020 population was between 8.5 and 9.6 million.
2. (Pacific Community 2020). This is the proportion of the total population who live in rural areas, that is, those who are not living in urban areas. Most rural dwellers are rural villagers, but some live in non-village situations, such as schools, small government stations, mission stations, plantations or mining camps.
3. (Bourke et al. 2009:131; Bourke et al. 2006:24; Bourke 1999) for PNG, Solomon Islands and Vanuatu respectively.
4. (Bourke et al. 2009:138-144; Bourke et al. 2006:22-23; Bourke 1999) for PNG, Solomon Islands and Vanuatu respectively.

Use of cash to purchase food

The second important reason that food security has improved for rural villagers is improved access to cash to buy imported

or locally grown food when subsistence crops are inadequate. Sales of imported rice increase sharply after major natural disasters such as cyclones, drought and frost. Much of the imported rice, wheat-based foods, vegetable oil, canned fish and meat is consumed by those living in urban and rural non-village areas. Some peri-urban families obtain much of their food energy from imported foods while villagers with limited links to markets rarely consume imported foods. Generally, rural villagers in the SW Pacific obtain up to 20 per cent of their food energy from imported foods.

Malo Island in Vanuatu provides a fairly typical regional example of island-based villagers in the region. Allen (2015) documented that on average a resident of Malo derives around 20 per cent of their calories from food imports and that, in most years, this could be easily substituted with surplus subsistence production.

Rural-urban links

The third factor which has improved food security for rural villagers is links with urban relatives although this has less impact compared to access to cash and adoption of new food crops. Nevertheless, when subsistence food production is inadequate, some urban dwellers transfer money to their rural-based relatives to enable them to purchase food. This is more common during cyclones, severe drought and frost when gardens are destroyed.

Efficient supply chains for imported rice and wheat-based foods would facilitate the availability of foods that can be readily stored and transported long distances. The same supply chains, however, also facilitate the widespread availability of items with low food value and those associated with poor health outcomes, particularly carbonated drinks and food with a high sugar content.

Changes in nutritional status

In the 1960s and 1970s, dietary surveys of many groups in PNG whose nutrition had changed little from precolonial times found that diets in some areas were 'grossly inadequate' (Korte, 1976). In a review of human nutrition in PNG, Heywood and Nakikus (1982) reported that many low-protein diets and a limited amount of available food often resulted in slow physical growth of children, (Mueller, Vounatsou et al. 2001) and stunting, high infant death rates, girls not maturing until their late teens (Mueller and Smith 1999), and stunting in adults. When people adopted cash crops and started buying imported food, including protein-enriched rice, tinned fish and meat, diets improved significantly and people were able to get through periods of overall food shortage.

Since about 1990, however, the rate of nutritional improvement has slowed and in some communities may have ceased. The limited number of trustworthy surveys with large samples means little recent reliable information is now available.[1] Today, undernutrition in children under the age of five remains a significant problem in PNG, Solomon Islands and Vanuatu, as well as some other Pacific Islands nations (SPC 2011). In PNG, almost half of children under five years old and one-third of children in Solomon Islands and Vanuatu, are stunted – the result of inadequate food intake over a long period. In PNG, there is a reasonably high level of wasting, which indicates short-term malnutrition. This is less widespread in Vanuatu and Solomon Islands (Table 2).

Over a third of women of reproductive age in PNG and Solomon Islands and about a quarter of women in Vanuatu are anaemic (Table 2). As well as indications of undernutrition, a significant proportion of adults in all three nations are obese and suffer from diabetes (Table 2). The combination of increasing consumption of imported staples and increasingly sedentary lifestyles has resulted in Pacific populations being not only among the most obese in the world, but have the highest prevalence of type 2 diabetes. Poor diet has also contributed to a number of other non-communicable diseases, such as increased hypertension and cardiovascular disease. These are overwhelmingly urban problems.

Table 2: Prevalence of under- and over-nutrition in Papua New Guinea, Solomon Islands and Vanuatu, by percentage

Parameter	PNG	Solomon Islands	Vanuatu
Stunting, children under-5	49.5	31.6	28.5
Overweight, children under-5	13.7	4.5	4.6
Wasting, children under-5	14.1	8.5	4.4
Anaemia, women of reproductive age	36.6	38.9	24.0
Obesity, adult women	25.8	27.1	30.1
Obesity, adult men	16.6	17.9	20.2
Diabetes, adult women	14.3	15.1	16.0
Diabetes, adult men	15.4	12.6	15.7

Source: Global Nutrition Report 2020

Issues of under- and over-nutrition (obesity) have implications for economic development. At a national level, they may be associated with a shortened life expectancy; reduced productivity in both subsistence and formal sectors; reduced possibility for children attaining their physical and intellectual potential; and high levels of stress on health systems.

Threats to food security

Rapid population growth: One of the most important long-term threats to food security in the SW Pacific is rapid population growth. Given the high proportion of the population who live in rural villages and grow most of their own food, there is growing pressure on agricultural land leading to reduced soil fertility in many locations. In the islands and PNG lowlands, this pressure has been absorbed by the adoption of new food crops, particularly sweet potato. The dependence on sweet potato in some locations means that past gains in productivity are now being overtaken by population growth and pressure on land. This is particularly

marked in the PNG highlands where there are few alternative food crops that grow well at higher altitudes.

In response, large areas of other food crops are being planted by villagers, particularly bananas in the highlands; cassava in the lower areas (up to 1500 m); and 'English' potato at high altitude locations (over 2000 m). Land use is being intensified through either addition of organic matter or a rotation of sweet potato with peanuts. Despite these changes, as the population continues to increase there is increasing pressure on land and food security in many parts of PNG's central highlands.

The high dependence on sweet potato is also becoming an issue in Bougainville and Buka Islands where excessive soil moisture on sweet potato tubers has led to food supply vulnerability. This is being exacerbated by climate change.

Climate extremes: Subsistence food production is reduced by climatic extremes such as drought, cyclones and frost (Cobon et al. 2016). Recent examples include tropical cyclone Pam in Vanuatu in 2015, drought (and frost at very high altitudes) in PNG in 1997 and 2015 resulting in widespread food shortages (Allen and Bourke 2001; Kanua et al. 2016), and extended periods of very high rainfall. The impact of very high rainfall on tuber yield is generally underestimated but when rainfall is excessive, the above ground vegetation of the crop is particularly vigorous and the low yield not apparent until harvest time. The impact of very wet soils occurs in the first 6–8 weeks after planting, but the impact is not apparent until many months later during the tuber bulking phase.

Other natural events: Floods, landslides, earthquakes and tsunami can also destroy crops; however, the impact on food supply is generally much less than that from drought, frost and very high rainfall. Increasingly, pest and disease issues are affecting food gardens in the region but there is only limited information on their impact on yield.

Climate change: The climate in the region is changing rapidly with increasing temperatures, rising sea levels and changing rainfall patterns with further changes forecast (Lough et al. 2016). Rapid temperature increases in the New Guinea highlands have meant increases in the altitude at which crops can be grown. For example, coconuts bear at 1600m in the PNG highlands whereas 40 years ago, the very highest location at which nuts could be harvested was 1310m (Bourke 2010). Rising sea level is impacting on people on atolls and some other very small islands, with saline water now affecting production of the staple food swamp taro (*Cyrtosperma chamissonis*) on atolls east of Buka Island in PNG and the nearby Ontong Java atoll in Malaita Province, Solomon Islands. It is likely that increasing temperatures, rising sea levels and increasing rainfall will have a serious impact on the production of some food crops in coming decades (McGregor et al. 2016).

Food security vulnerability: Populations most vulnerable to food shortages are those living in remote areas with poor market access, limited access to health and education services, low cash income and, sometimes, limited capacity to gain outside assistance. People living on small islands with a high to very high population density are particularly vulnerable, such as Tongoa, Paama and North Pentecost in Vanuatu or remote atolls and small islands in the Autonomous Region of Bougainville, Milne Bay Province and elsewhere in PNG. Other locations where people are particularly vulnerable in PNG include those at very high altitudes (over 2200m); those in locations between the central highlands and the lowlands; and the Strickland-Bosavi sub-region in Western Province.

Nutrition, hygiene and health education: Providing information on basic human nutrition, hygiene and health is a critically important way of improving the lives of rural villagers. It is particularly important to provide training to schoolteachers and schoolchildren as most of the latter group will be parents within a decade of leaving school.

Conclusions

The majority of people in PNG, Solomon Islands and Vanuatu are rural villagers who produce most of their own food from gardens, tree crops, fishing and domestic animals. Sweet potato is the most important food crop in PNG and Solomon Islands. Other staples include banana, coconut, yam, cassava, sago, taro and tannia. These crops are also grown in Vanuatu, aside from sago, but no single crop is dominant. Over the past 80–140 years, food security has improved in these countries because of the adoption of more productive food crops, most of which were domesticated in Central and South America, access to cash that can be used to purchase food when subsistence supplies are inadequate, and, to a much lesser degree, support from urban-based family members.

Significant gains in human nutrition over the past 60 years have been documented, at least in PNG, and this is associated with access to cash from cash cropping. Nevertheless, undernutrition of children remains a major impedement to human development in all three nations, as does high levels of anaemia in women. A significant proportion of people in all three nations are obese and suffer from diabetes, particularly in urban areas.

Food security is threatened by rapid population growth and consequently more intensive land use and reduced soil fertility in many locations. Extreme climate events particularly drought, frost and prolonged periods of very high rainfall also reduce food supply in many parts of this subregion. Global climate change is starting to impact food supply particularly on atolls and other very small islands, and this is likely to increase in coming decades. Villagers who have the greatest vulnerability to chronic and short-term food security generally live in more remote locations where access to markets, health facilities and cash income is limited.

Food security issues can be addressed through three main mechanisms:

- research and outreach to improve food production;
- greater access to cash income for rural villagers, with sale of agricultural produce the best option for most rural villagers; and
- education in basic human nutrition, hygiene and health for all those of school age.

Note

1. Important studies include a major 1956 study in Sinasina, Simbu Province (Venkatachalam 1962) and a restudy in the same location in 1981 (Harvey and P Heywood 1983); the very comprehensive 1982–83 National Nutrition Survey and extensive analysis of this (Heywood, Singleton and Ross 1988; Mueller and Smith 1999; Mueller et al. 2001); and the 2018 IFPRI surveys in four lowland locations (Schmidt et al. 2019).

References

Allen, BJ and RM Bourke 2001, 'The 1997 drought and frosts in Papua New Guinea: Overview and policy implications', RM Bourke, MG Allen and JG Salisbury (eds), *Food Security for Papua New Guinea. Proceedings of the Papua New Guinea Food and Nutrition 2000 Conference*. *ACIAR Proceedings No. 99*, Australian Centre for International Agricultural Research, Canberra, 155–163, www.aciar.gov.au/node/12511

Allen, MG 2015, 'Framing food security in the Pacific Islands: Empirical evidence from an island in the Western Pacific', *Regional Environmental Change,* 15, 1341–1353, https://doi.org/10.1007/s10113-014-0734-5

Bourke, RM 2010, 'Altitudinal limits of 230 economic crop species in Papua New Guinea', in SG Haberle, J Stevenson and M Prebble (eds), *Altered Ecologies: Fire, Climate and Human Influence on Terrestrial Landscapes. Terra Australia* 32, ANU E-Press, The Australian National University, Canberra, 473–512, http://press-files.anu.edu.au/downloads/press/p18701/pdf/ch271.pdf

Bourke, RM and B Allen forthcoming, 'Estimating the population of Papua New Guinea in 2020', *Asia and Pacific Policy Studies*.

Bourke, RM, J Gibson, A Quartermain, K Barclay, B Allen and J Kennedy 2009, 'Part 2. Food production, consumption and imports', RM Bourke and T Harwood (eds), *Food and Agriculture in Papua New Guinea,* ANU E Press, The Australian National University, Canberra, 129–192, http://press-files.anu.edu.au/downloads/press/p53311/pdf/part21.pdf

Bourke, RM, A McGregor, MG Allen, BR Evans, BF Mullen, AA Pollard, M Wairiu and S Zotalis 2006, *Solomon Islands Smallholder Agriculture Study. Volume 1. Main Findings and Recommendation*s, AusAID, Canberra, http://dfat.gov.au/about-us/publications/Documents/solomon_study_vol1.pdf

Cobon, DH, M Ewai, K Inape and RM Bourke 2016, 'Food shortages are associated with droughts, floods, frosts and ENSO in Papua New Guinea', *Agricultural Systems.* 145, 150–164, www.researchgate.net/publication/299655723_Food_shortages_are_associated_with_droughts_floods_frosts_and_ENSO_in_Papua_New_Guinea

Connell, J 1978, 'The death of taro: Local responses to a change of subsistence crops in the Northern Solomon Islands', *Mankind* 11(4), 445–452.

Global Nutrition Report 2020, *Global Nutrition Report in the context of COVID-19*, https://globalnutritionreport.org/reports/2020-global-nutrition-report/

Heywood, P and M Nakikus 1982, 'Protein, energy and nutrition in Papua New Guinea', in RM Bourke and V Kesavan (eds), *Proceedings of the Second Papua New Guinea Food Crops Conference: Part Two*, Department of Primary Industry, Port Moresby.

IFPRI (International Food Policy Research Institute) 2020, *Food security*, Washington, www.ifpri.org/topic/food-security

Iese, V, E Holland, M Wairiu, R Havea, S Patolo, M Nishi, T Hoponoa, RM Bourke, A Dean and L Waqaibete 2018, 'Facing food security risks: The rise and rise of sweet potato in the Pacific Islands', *Global Food Security,* 18, 48–56, www.researchgate.net/publication/326982032_Facing_Food_Security_Risks_The_Rise_and_Rise_of_Sweet_Potato_in_the_Pacific_Islands

Kanua, MB, RM Bourke, B Jinks and M Lowe 2016, *Assessing village food needs following a natural disaster in Papua New Guinea*, Church Partnership Program, Port Moresby, https://openresearch-repository.anu.edu.au/bitstream/1885/109282/1/Assessing-food-needs-following-a-natural-disaster-in-Papua-New-Guinea.pdf

Korte, R 1976, 'Food and nutrition in Papua New Guinea', in K Wilson and RM Bourke (eds), *1975 Papua New Guinea Food Crops Conference Proceedings*, Department of Primary Industry, Port Moresby.

Lough, J, AS Gupta, SB Power, MR Grose and S McGee 2016, 'Observed and projected changes in surface climate of tropical Pacific Islands', M Taylor, A McGregor and B Dawson (eds), *Vulnerability of Pacific Island Agriculture and Forestry to Climate Change*, Pacific Community, Noumea, 47–101.

Malinowski, B 1935, *Coral Gardens and Their Magic: A Study of the Methods of Tilling the Soil and of Agricultural Rites in the Trobriand Islands*, 2 volumes, George Allen and Unwin, London.

McGregor, A, M Taylor, RM Bourke and V Lebot 2016, 'Vulnerability of staple food crops to climate change', M Taylor, A McGregor and B Dawson (eds), *Vulnerability of Pacific Islands Agriculture and Forestry to Climate Change*, Pacific Community, Noumea, 161–238, www.spc.int/DigitalLibrary/Doc/LRD/Agriculture/Vulnerability_Pacific_agriculture_climate_change.html

Mueller, I and TA Smith 1999, 'Patterns of child growth in Papua New Guinea and their relations to environmental, dietary and socioeconomic factors – further analyses of the 1982–83 Papua New Guinea National Nutrition Survey', *Papua New Guinea Medical Journal*, 42, 3-4, 94-113, www.researchgate.net/publication/11911251_Patterns_of_child_growth_in_Papua_New_Guinea_and_their_relation_to_environmental_dietary_and_socioeconomic_factors_-_Further_analyses_of_the_1982-1983_Papua_New_Guinea_National_Nutrition_Survey

Mueller, I, P Vounatsou, BJ Allen and T Smith 2001, 'Spatial patterns of child growth in Papua New Guinea and their relation to environment, diet, socio-economic status and subsistence activities', *Annals of Human Biology*, 28(3), 263–280, www.tandfonline.com/doi/abs/10.1080/030144601300119089

Pacific Community 2020, *Pocket Statistical Summary*, Pacific Community, Noumea, www.spc.int/DigitalLibrary/Get/vrca

Packard, JC 1975, *The Bougainville Taro Blight*, Miscellaneous Work Papers 1975, 1, Pacific Islands Program, University of Hawaii, Honolulu.

SPC 2011, 'Food security in the Pacific and East Timor and its vulnerability to climate change', Secretariat of the Pacific Community in conjunction with CSIRO, Noumea, www.environment.gov.au/system/files/pages/275228c5-24db-47f2-bf41-82ef42cda73d/files/food-security-report.pdf

Venkatachalam, PS 1962. *A Study of the Diet, Nutrition and Health of the People of the Chimbu Area (New Guinea Highlands)*, Department of Public Health Monograph No.4, Territory of Papua New Guinea, Port Moresby.