In the Time of Frost: El Niño and the Political Ecology of Vulnerability in Papua New Guinea

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Climatic anomalies associated with El Niño bring prolonged droughts and night-time frosts that devastate subsistence gardens in the Papua New Guinea highlands. As a customary process of adaptation to the subsequent food insecurity caused by crop-destroying frosts, people migrate to lower altitude areas where kin and friends provide sustenance and social support. However, with increasing economic development and the demise of collective kin endeavours in the region, long-distance migration networks no longer appear to offer people respite from food insecurity. In this paper, I examine the changes in social responses to El Niño-caused food shortages at varying scales – from subsistence farmers to international aid agencies – over the past several El Niño events. The paper explores the production of vulnerability when customary social-ecological systems of adaptation intersect with regional and national politics, development efforts, and humanitarian aid agencies.

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ABSTRACT

Climatic anomalies associated with El Niño bring prolonged droughts and night-time frosts that devastate subsistence gardens in the Papua New Guinea highlands. As a customary process of adaptation to the subsequent food insecurity caused by crop-destroying frosts, people migrate to lower altitude areas where kin and friends provide sustenance and social support. However, with increasing economic development and the demise of collective kin endeavours in the region, long-distance migration networks no longer appear to offer people respite from food insecurity. In this paper, I examine the changes in social responses to El Niño-caused food shortages at varying scales – from subsistence farmers to international aid agencies – over the past several El Niño events. The paper explores the production of vulnerability when customary social-ecological systems of adaptation intersect with regional and national politics, development efforts, and humanitarian aid agencies.

KEYWORDS

Food security; El Niño; Papua New Guinea; vulnerability; political ecology

Introduction: Drought, Frost, and El Niños in Highlands Papua New Guinea

In western Enga Province in the highlands of Papua New Guinea (PNG), communities of Enga speakers periodically experience months of drought accompanied by several nights of frost, the latter of which completely destroy their crops. The most severe of these events occur in conjunction with strong El Niños, typically El Niño events that surpass one and half standard deviations from the norm as measured by the El Niño-Southern Oscillation (ENSO) Index (Jacka 2015). Wage and Kandep are two regions in western Enga Province where the most significant impacts of El Niño are felt. Both areas are in high altitude basins over 2400 m above sea level. During cold, clear nights the surrounding mountains trap the frigid air, killing subsistence crops (especially the staple, sweet potato [Ipomoea batatas]), pandanus trees, and even the natural vegetation on the lower forested slopes around the basins. While strong El Niños have likely impacted this area for centuries, during the period covered by oral histories the years 1941, 1972, 1982, 1997–1998, and 2015–2016 are recalled as particularly detrimental (for earlier dates, see Allen, Brookfield, and Byron 1989; Brookfield 1989).
Engans have several customary responses to these climatic disasters. Following the 1972 El Niño, Eric Waddell (1975) listed three responses of increasing magnitude as to how the Enga cope with frost based on the intensity of the disruption (cf. Wohlt 1989). As even minor frosts are common in the highlands of PNG, above about 1500 m, gardens are planted in mounds, which position the crops above the low-lying frost zone along the ground. In response to minor frosts, the Enga also have what Waddell called a local-level response where gardens are planted in two distinct ecological niches, one on the valley bottoms, the other on the lower slopes. While the former are acknowledged to be more productive, they are also more vulnerable to frost damage. However, during severe frosts even the gardens on slopes have the potential to be destroyed. In this event, Enga also have an intraregional level response wherein various household garden plots are in different locations up to about a day’s walk away from one another. As these are still in the frost zone, though, severe frosts can also destroy these gardens. Finally, the Enga can utilise the extraregional-level response in which they will migrate to communities lower in altitude below the frost zone where they will be given food and gardens by individuals with whom they have previously established exchange relationships until such time as they can re-establish their gardens in their home regions. Traditionally, people from Wage and Kandep have migrated in multiple directions out of the region to lower altitude dwelling groups – to the northwest among Ipili speakers in Porgera, north and northeast into Enga speaking areas along the Lagaip and Lai Rivers, to the east in the Saka Valley among Enga speakers, and to the south and west among North Mendi, Wola, and Huli peoples. In this article, I focus on their migrations into the Porgera region where I have conducted research since 1998.

The system of extraregional migration that mitigated food insecurity after frosts was likely produced following the adoption of sweet potato as a staple crop. While there is substantial debate about the actual timing of the introduction of sweet potato into Melanesia from South America (Ballard et al. 2005), oral history evidence indicates that in the Enga region, sweet potato arrived around 200–400 years ago (Wiessner 2005). Prior to its introduction, people would have been limited to growing taro (Colocasia esculenta) as their staple, and would not have been cultivating crops above 2200 m (Brookfield and Allen 1989). Sweet potato facilitated high altitude living by extending the range of cultivation to nearly 2800 m. It also promoted increasing production as it could be fed raw to pigs, which could then be funnelled into expanded ceremonial exchanges and political organisation (Wiessner and Tumu 1998).

The Australian colonial government’s response to the 1972 El Niño was to organise a Famine Relief Programme to supply supplemental food and planting materials to the affected populations. Food aid consisting of 0.23 kg of white rice per person per day and one tin of fish per person per week were distributed within three weeks of the last frost outbreak. The rice quota was ‘quickly’ raised to 0.45 kg. Fish was included for its ‘morale maintaining value’ (Waddell 1989, 212). Planting materials consisted of Ipomoea runners, Irish potato (Solanum tuberosum) seed, and vegetable seed packs comprising peas, beans, and cabbage. A longer-term objective of the seed distributions was to encourage a shift away from sweet potato to more resilient crops to reduce vulnerabilities in highlands food production systems (Waddell 1989, 213). While some colonial officials were aware that people had migrated during the 1941 El Niño, Waddell (1975, 250, emphasis in original) argued that they interpreted this as ‘a disorganized fleeing of starving
victims from the disaster area’ and not as ‘a structured response to the situation’. As a result, the government, following World Health Organization guidelines, discouraged migration due to the secondary effects it was believed to cause such as social disruption and spread of disease. While the Famine Relief Programme was successful in that no great loss of life occurred, Waddell (1975, 272) argued that future responses should ‘supplement and strengthen customary mechanisms for coping with the frost hazard’, rather than undermining them. However, since 1975 there were a variety of processes that were already undermining customary responses to frost. New crops from temperate regions, such as Irish potatoes and cabbages (*Brassica oleracea*), could withstand frost exposure. Also, new rural agricultural development activities fostered increases in cash incomes which could be used to purchase foodstuffs, mitigating the need to migrate out of the frost region during climatic disasters. As well, the traditional economic role of high-altitude Engans as traders of key resources, such as stone axes, shells, and salt, was becoming diminished under the pressure of commercial expansion in the highlands, which replaced the previously exchanged resources and improved transportation via roads and public motor vehicle (PMV) networks (Waddell 1975, 268–270).

In the 40-plus years since these events, three more El Niño-caused droughts and frosts, in 1982, 1997–1998, and 2015–2016, have impacted this region. At the same time, the PNG state gained independence (1975) and other development activities, particularly mineral and petroleum extraction, have re-shaped livelihoods and social relations in the area. Currently, two major extractive projects, the Porgera Gold Mine to the northwest of the Wage and Kandep area and the PNG Liquid Natural Gas (PNG LNG) project to the southwest of the area, infuse significant quantities of cash into the larger region. As well, throughout the region market opportunities from cash crops, trade stores, chicken raising, and PMV operations have increased local incomes. These benefits have been offset, though, by conflicts related to uneven development (Jacka 2015) and increased conflicts surrounding dissatisfaction with mining benefit (Burton 2014; Jacka 2019), which have fractured social relations in the area, which were previously based on ties of long-term reciprocity and delayed exchange mechanisms.

In late 2015, I received a rapid response grant from the National Science Foundation (US) to investigate social responses to the ENSO and one of my major questions was: Are customary responses such as migration still operative in an era of resource development, social conflict, and land pressure? Data for this article come from my previous experiences in Porgera after the 1997–1998 El Niño (14 months of field research), two months of field research in 2006 in Porgera, and three months of field research in 2016 in Wage, Kandep, and Porgera. In this article, I examine the impacts that these new political, economic, and ecological forces have had on customary responses to the previous two El Niño events. I first examine the anthropology of disaster and vulnerability, using the lens of vulnerability – defined as the ‘degree to which a [social-ecological] system is susceptible to and is unable to cope with adverse effects’ from disturbances (Adger 2006, 269) – to explore the processes which are understood to exacerbate the effects of disaster. In the following two sections, I discuss the social contexts of the extraregional level response as described by individuals in western Enga Province from the 1941 to the 2015–2016 El Niños. Following this, I describe the national and international efforts to mitigate food insecurity during the 2015–2016 El Niño. In the final two sections, I highlight the multi-scalar production and mitigation of vulnerability related to food insecurity.
Disasters and Vulnerability

Waddell’s argument about the Australian colonial government exacerbating the risks of disaster for high altitude-dwelling Engans was prescient. Starting in the 1980s, social scientists began seeing disasters not as ‘extreme and unpredictable’ natural events (Oliver-Smith 1996, 304; Hoffman and Oliver-Smith 1998; Faas and Barrios 2015; Barrios 2017), but rather as products of the interaction of social, political, economic, and ecological forces, often discussed within the context of global climate change processes.

Disasters are composed of slow and fast onset processes. Typically, disasters are conceptualised in their fast onset dimension – the tsunami, fire, or earthquake. But disasters also occur over longer time scales. For the 1970 earthquake in Peru which killed over 70,000 people, Anthony Oliver-Smith (1994) characterised this as a ‘five hundred year earthquake’ in that the preconditions for the vast number of deaths were created in the context of Spanish colonisation which transformed building materials and settlement patterns (Faas and Barrios 2015). Droughts and accompanying famines occur over several months and are characteristic of slower-onset disasters (Torry 1986). ENSO-caused droughts in PNG have both slow and rapid onset dimensions. Initially, regular rainfall ceases for some number of months, and then when conditions are right – on cloudless, cold nights – frosts occur destroying subsistence gardens in a matter of hours. Continued droughts after frosts prevent replanting. Once people can plant again, their staple crop of sweet potatoes fails to produce tubers due to excess nitrogen being built up in the soil from the lack of rainfall (Bourke 1988, 2000).

Disasters have differential effects on society and environment as a function of vulnerability. The more vulnerable the social-ecological system, the greater the disturbance or disaster will be felt. Vulnerability is rarely an innate aspect of a system, though, and is often exacerbated by human activities, intentional or otherwise (Hewitt 1983). As such, vulnerability articulates well with research in a political ecology framework, defined here as a combination of political economy and ecology, with special attention paid to the power dynamics inherent in ‘the constantly shifting dialectic between society and land-based resources, and also within classes and groups within society itself’ (Blaikie and Brookfield 1987, 17). In this article, I am interested in examining in depth the production of vulnerability through resource development and the state and how these forces reshape human-environment and human-human interactions, through what I am calling the political ecology of vulnerability.

Central to conceptualisations of political ecology is the recognition that struggles over the access to and control over resources shapes most human-human and human-environment interactions (Robbins 2004). Socionatural disasters significantly shape who has access to and control over resources – and subsequently conditions of vulnerability, but as I examine in this article, the issue of geographic scale is also important. Local, regional, national, and international actors and processes both increase and decrease vulnerability in complex ways. Scalar research in political ecology explores the ‘nested and articulated’ (Swyngedouw and Heynen 2003) aspects of geographic scale in which people and events at one scale impact people and events at another scale in non-deterministic and unexpected ways, both vertically (nested) and horizontally (articulated). Disasters often occur at local or regional scales that set into motion responses from local to global scales. Studying these responses and seeing disasters as multi-scalar thereby provides a theoretical basis for a
better understanding and critique of the social and environmental conditions underlying the political ecology of vulnerability. Also critical to understandings of scale, political ecology, and vulnerability is the role of capitalism and the state (Heynen 2003; Smith 2008; Neumann 2009). Building upon Lefebvre’s (1991) ideas about changes in the mode of production and ‘the production of space,’ critical scalar theory in geography argues that scale is also produced, particularly in regards to what Neumann (2009, 403) calls ‘the scalar politics of the state in struggles over the control of resources and the environment more broadly’. More broadly, Zimmerer and Bassett (2003, 3) argue that ‘diverse environmental processes interact with social processes, creating different scales of mutual relations’.

The Social Contexts of Migration in the Time of Frosts

Western Enga Province is a rugged landscape characterised by limestone mountains cloaked in the dense rain forest. Punctuated throughout the southern portion of the region are high-altitude lakes and swamps on a mountainous plateau above 2400 m above sea level. Just to the north of the plateau, the Lagaip River runs from east to west. V-shaped valleys incise the northern edge of the plateau where they meet the Lagaip River at about 900 m above sea level. The western portion of the plateau is called Wage and contains dozens of hamlets of Enga speakers. To the east is Kandep, a flatter region more densely populated (also with Enga speakers) where the main town and government station is located – also called Kandep. Approximately two to three days walk northwest of Wage is the Porgera valley where people live and garden between 1600 and 2400 m above sea level. The land between Porgera and Wage is too high for cultivation with peaks nearly 3900 m high separating the two areas. Porgera was traditionally the homeland of Ipili speakers – a separate language in the Enga language family. Cultural and subsistence practices among Wage, Kandep, and Porgera are similar. People live in scattered households in hamlets, grow subsistence gardens, and are connected through dense networks of kinship, ritual, and exchange.

Genealogies and oral histories depict a long tradition of interactions between the Enga and Ipili in western Enga. One of the most common stories that people tell relates to migrations linked to frost events that destroy sweet potato gardens in Wage and Kandep. One Kandep man described what his grandfather went through after the 1941 frost:

My grandfather has told me about the time that the frost came before there were white men here. He left Kandep with 17 other people. […] They spent two days walking to Wapenamanda, but there had been frost there, too, so there was no food. They went to Laiagam and then Mulitaka. They were starving and foot sore, and sleeping at the base of trees. They all died on the road except for my grandfather. He survived by eating the insides of a tree fern. (Lako Nancy, male, 40s, Kandep, 12 Jan 2016 interview)

Deciding when to migrate can be critical for survival. Generally, the earlier a family decides to leave, the better off they are. As recounted by a Porgera man who has hosted many families following frosts:

When the dry season comes, the frost usually comes, too. It will be dry for two to three months, then in the night the frost comes like stones falling from the sky. Once the sun
...rises it all turns to water. After a week, all of the sweet potato and pandanus is destroyed, even the sweet potato in the ground. Then the people start to come here [Porgera]. The first ones that come are usually in better shape. The ones that come later are pretty bad off. Before the white men were here [referring to the 1941 El Niño] about 20 people died on the Asienda road that goes to Wage. (Pes Bope, male, 70s, Porgera, 13 Jan 2016 interview)

Pes, like many Porgerans, has an ancestress who originally came from Wage or Kandep during a frost and then married into one of the Porgeran kin groups (see Waddell 1989; Wohlt 1989). This, in fact, is one of the main factors that generate the long-distance migration networks. ‘Women are bridges’ is a common refrain as it is through female kinship links that relatives can go and live on the lands of other kin groups. This concept also played out in pre-contact rituals during food shortages. Oral history documents sweet potato being brought to Enga by two sisters. During famine times, people along the Lagaip River valley would build a bridge decorated with sweet potato vines which women would dance across while carrying sweet potato vines to return fertility to the region (Wiessner and Tumu 1998, 104–109). Pes’s wife’s mother was from Wage and came to Porgera during the 1941 frost. He maintained and fostered this connection to Wage through periodic trips to obtain pigs for exchanges and visit his wife’s maternal kin. Hosts expect then that migrants will bring pigs and women after frosts strike. As Waddell (1989, 219) notes, these crises provide an opportunity for host groups to ‘acquire a needed infusion of population’. Periodically, the migrants will return, check on their crops, and then come back down to their hosts’ lands (what Waddell 1989, 218 calls ‘commuting’; see also Wohlt 1989).

The opportunities generated by crises of food insecurity can sometimes be resented by the migrating groups. Given the lengthy stays, relationships develop and young people can marry their hosts often forgoing bridewealth exchanges since there are not enough resources to sponsor a major exchange. The Engans resent this and Pes recited a *singsing* that the Wage and Kandep use sometimes when former hosts come to ask them for pigs for exchange purposes:

> It was just a little while ago during the dry season that you took our women and pigs for free, now you come and ask for them again, now do you plan to live here, or will you ask me for something more?

Following a frost in 1980 in this area, Wohlt et al. (1982, 16) noted that people were reluctant to migrate to lower elevations for fear of creating debts with their hosts (see also Waddell 1989, 219). While this is an adaptive strategy, as these examples show, it sometimes is not the preferred option. Moreover, polygyny is decreasing in the area (Wardlow 2006), which would also have been adaptive by spreading the household across multiple locations. With this decline, vulnerabilities are also increased.

With the opening of the world-class Porgera Gold Mine in 1990, Engans and other groups around Porgera poured into the valley, increasing a pre-mine population of 9000 to around 20,000 by the late 1990s (Filer 1999; Golub 2014; Jacka 2015). Porgerans welcomed the outsiders as they noted that ‘land is plenty, people are few’, providing them land for gardening and incorporating them into their kin groups through marriage and exchange. The 1997–1998 ENSO-caused drought was in all likelihood the most severe drought in the twentieth century (Allen and Bourke 2001, 156). Its onset began around March 1997 and lasted until February 1998. Frost impacted areas as low as 1400 m.
Similar to the responses following the 1972 El Niño, the government, churches, businesses, and aid groups provided food aid in Wage and Kandep, although in a ‘somewhat haphazard’ manner (Allen and Bourke 2001, 158). According to migrants, the food aid was inadequate and arrived too late. Consequently, following the frost-caused crop losses in Wage and Kandep, many households in the eastern Porgera valley hosted migrants from these areas, as they had in past El Niños. In two hamlets in the eastern Porgera valley in a census I conducted in January 1999, 5% of the population was still composed of Wage and Kandep migrants, although according to residents, most of the migrants had already returned to their homes.

The 1997–1998 El Niño demonstrated that previous experiences of food insecurity had dramatically different responses at the local scale versus the provincial and national scales. Engans from Wage and Kandep mobilised the networks that their parents, grandparents, and ancestors had utilised in past El Niños to reduce their vulnerabilities to shocks in the food supply. At provincial and national scales, however, there were multiple problems with the crisis response as detailed by Allen and Bourke (2001). These ranged from the demise of weather observation stations across PNG to barely functioning government services across multiple sectors. Moreover, there was poor management of the National Disaster and Emergency services organisation, a three-month delay in setting up a trust fund to receive monetary aid from donors, and aid funds being delivered to all members of parliament regardless of the food security situation in their districts. Meanwhile, AusAID and the Australian Defence Force used the crisis as an opportunity in ‘competitive public relations’ to ‘rescue’ PNG (Allen and Bourke 2001, 159). Without the intervention of the international aid sector and churches, the crisis would have been much more severe. Yet, as Allen, Brookfield, and Byron (1989, 159) document, private citizens in PNG bought and distributed orders of magnitude more rice than either the PNG or Australian governments, leading them to conclude that ‘the great majority of people in PNG who needed food ... were ‘saved’ either by their own ingenuity and cash savings, or by their relatives and families’.

The 2015–2016 El Niño

The 2015–2016 ENSO started in April 2015 and ended in most parts of the country by January 2016. Five nights of frost in August 2015 in Wage and Kandep destroyed the staple sweet potato crop, ruining the tubers in the ground as well. While the frost destroyed gardens in August, the months-long drought prior to this time also impacted the staple sweet potato. One of the novel aspects of this El Niño is that mobile phone towers had been erected in most of the country allowing people to determine conditions in other areas prior to considering migrating. In Wage and Kandep, many people we interviewed noted that they had called wantoks (Tok Pisin term, ‘one talk,’ meaning someone from your group or area, or a friend) who told them that people in Porgera were not sharing food so to not bother to migrate. Moreover, not having any wantoks outside of Wage and Kandep was another reason people mentioned not migrating. When I asked Jenny Dilly, headmaster of Longap Primary School, why fewer people had migrated, she reasoned:

Some of us have been getting help from our wantoks who have jobs. Some of us have children who have left and have jobs who can help us. Some people have been able to come and go. But
not everyone, Jerry, is this privileged. There are only about ten or so who are able to do this. Not everyone comes and goes. Many of the people are just subsistence farmers, and are just waiting to die. (19 Jan 2016 interview)

Karep Karet, a man in his 50s in Kandep emphasised this as well:

After the frost came, whoever had money, left, and went to Mt. Hagen or Porgera or other places. Those of us who don’t have money – old people, kids – we just stay here and die. Birds depend upon trees, but people depend upon the land. Now our land is destroyed and we are hungry. [...] When the frost came, I walked down to the Marient side [east of Kandep], but it was destroyed too so I came back here. I don’t have any wantoks who could help me. I don’t know anyone outside Kandep so I just stayed here. I sold a little pig for K700 (≈ US$225) and bought rice and food but that money is gone now. (25 May 2016 interview)

In interviews with people in Porgera who had hosted Engans during previous El Niños, they were uncertain as to why fewer migrants had come. They speculated that perhaps they were afraid that there were still conflicts raging over dissatisfaction over resource development issues, or that perhaps the government and other aid agencies were supplying enough food to prevent food insecurity. To me, however, there were multiple factors at play. From a population of around 20,000 in 2000 there were now an estimated 50,000 people according to the multinational mining consortium, Porgera Joint Venture. As well, the 2004–2012 tribal fights in Porgera resulted in entire hamlets being burnt to the ground, especially the hamlets in the southeastern part of the valley where most Wage and Kandep people had established long-term exchange and marriage networks. Only in 2016 were these hamlets being rebuilt. As mentioned above by Jenny and Karep, the amount of money one has via work or wantoks also shaped people’s decisions over whether to migrate or not. For those people who do migrate, their circumstances can be quite different depending upon their wealth, status, and nearness to roads. Yakop Ili is a former council ward leader in Kandep who used some of his wealth to buy a ‘block’ (small piece of land) in Mt. Hagen in the early 2000s. He’s in his late 40s and has ‘plenty’ of wives, one in Laiagam, one in Mt. Hagen, and the rest in Kandep. In terms of migrating he notes:

After the 1997 frost, I went to Laiagam where one of my wives lives. I took my whole family there. We stayed there for four to five months and then I sent my wives back up to make gardens and since the frost had ended we all moved back up here. Now in 2015 I have plenty of wives and kids, so I sold two pigs to buy food after this last frost. For one pig I got K1300, for the other I got K800 (≈ US$675 in total). This money was gone in one month buying food from the store. With the money gone, we all went to live in Mt. Hagen. I left some of my family with wantoks who live around Mt. Hagen and some of us went to my block there to live. (26 May 2016 interview)

For some men, in contemporary times, wives thus serve as ‘roads’ not just as ‘bridges.’ While Yakop was telling me this story, a group of men were standing around listening. I asked the group if everyone who left had returned? Several of them emphatically stated that whoever had the wantoks or resources was gone, and wouldn’t be back for a while. I asked, ‘So you’re all stuck here because you don’t have any wantoks elsewhere?’ (Olsem yupela stap insait long banis bikos yupela no gat wantok autsait?) ‘That’s the absolute truth!’ (emphatic ‘em tru!’), they replied.
Josefin Buka, a woman in her 30s from Karekare (a hamlet in Wage about a day’s walk from Temberai in the bush), related a very different experience of migration. I interviewed her in Porgera in January 2016:

This dry season and frost has been really bad. It has destroyed our gardens, the trees in the forest, even the pandanus. It even ruined the sweet potato and the taro in the ground. The dry season has stopped, but it takes sweet potato twelve months to mature, and the greens that are growing aren’t ‘strong.’ When we eat them, they don’t satisfy our hunger. So we left and came here. I followed my lain [kin group], the Yomondaka, we’ve always maintained two lands, one in Wage and one in Porgera.

After the frost, the government gave every household rice – 10 kg for each household. We had to walk for a day just to go pick up the rice. But the government doesn’t think about how many people are in the house. We also raise a lot of pigs. Since we didn’t have any sweet potato, we had to feed our pigs rice, too. Once we ran out of food, we came here. We walked here on the bush road and had to sleep twice in the bush. It took us three days to walk here. […]

When the dry season lasts a long time, we start to think that frost might come, but we aren’t sure of the exact timing. When we’re sleeping, though, and it gets very cold, even if you double up your blankets and are still cold, then we know the frost is coming that night. In the morning we go outside and the frost is everywhere. […]

Jerry: What did you do with your pigs?

Some of us sell them. Some of us kill them or just turn them loose and let them fend for themselves. In the time of frost, we think about our lives, not theirs.

Josefin’s story highlights the importance of maintaining connections over time between hosts and migrants. The fact that her family had migrated in the previous El Niño in 1997 allowed for an easier transition into Porgera in 2015. In addition to clan lands that some groups maintain in Porgera, there are also three Wage and Kandep ‘camps’ in the Porgera valley (see also Waddell 1989). These camps are lands where high-altitude dwelling Engans have obtained long-term use rights from Porgeran hosts. Life in the camps is crowded and most people move back and forth between their low-density settlements with their abundant gardens and pig herds and the excitement of life in the mining communities surrounding Porgera (see Jacka 2015, chapter 7). In June 2016, I interviewed Langan Muri, one of the leaders in the oldest camp in Porgera, established during the 1972 ENSO. He said that during the worst part of the drought and frost several hundred people had moved through the camp from the Wage region. I asked how people could gain access to the camp. Langan noted:

You have to have some connection, you can’t just come. Jerry, you know the wantok system in PNG. There are five council wards from Upper Wage [the region of Wage closest to Porgera] that come here. If one’s parents or grandparents came before, like in 1972, or 1997, then they can follow their footsteps here. If none of your lain came, then you’ll just die in your village. (18 Jun 2016 interview)

By 2016, social life in western Enga Province had transformed dramatically since the last El Niño in 1997–1998. Economic inequalities stemming from mining development had created a system of ‘haves’ and ‘have-nots’ within the Porgera context resulting in frequent tribal fights and revenge killings (Burton 2014). Moreover, despite many pre-mining
Ipili in Porgera having dense kinship and exchange ties with Wage and Kandep people, the latter were now conceived of as the poor cousins to the Porgera based Ipili. The relative remoteness of Kandep, and especially Wage, which has no decent road for access, created further vulnerabilities in terms of people’s ability to migrate. Overall, though, in interviews with people in 2016 there was just a general sense that the dense network of exchange and marriage ties was disintegrating. As such, the customary mechanisms that fostered resilience – extraregional migration – is being eroded by increasing involvement in capitalist enterprises and a new focus on individuality as opposed to clan-based identities (Jacka 2019). It is in this context that outside interests coalesced around the food security crisis in PNG.

**Multi-scalar Efforts to Mitigate Food Insecurity**

As mentioned, drought started across most of PNG by April 2015. On 7 June 2015, the PNG National Weather Service warned of the strengthening El Niño in the Central Pacific. In the highlands, frosts occurred in late July and early to mid-August. Reports of the drought and the growing food crisis started appearing in the Australian media in late August. Based on the information that Provincial Administrators provided to the national government, a rapid assessment team was sent to the highlands on 23 August. They spent a week in the highlands and categorised several Local Level Government (LLG) areas as severely impacted by food insecurity (NDC 2016). In September 2015, the PNG government authorised each district (PNG’s provinces are composed of districts overseen by a District Administrator) to use up to K2 million (approximately US$700,000) for drought relief through the highly criticised (by PNG’s own Auditor-General’s Office) District Services Improvement Program (Wiltshire and Oppermann 2015). The use of funds through this program are frequently subject to political manipulation by the District Development Authorities who oversee their allocation.

This decentralised approach to dealing with the food security crisis by allowing District Administrators to allocate disaster funds and not the national government stands in stark contrast to what the PNG government claims is its official disaster response management strategy. The Disaster Management Act of 1984 created a National Disaster Centre, a National Disaster Committee (GoPNG 1984), and Provincial Disaster Committees. Both National and Provincial Disaster Committees are composed of various government officials such as heads of defence, police, health, and so forth. Funding comes from national and provincial coffers until K100,000 is spent at which time funding is borne by the national government. Following the 1997–1998 El Niño, when approximately 1 million people suffered from food insecurity and the Australian government provided AUD30 million in food aid (ESCAP 2016, 31), the World Bank provided a $5 million loan called the Emergency El Niño Drought Response Project (World Bank 2003). In June 2000, after providing $1.5 million of the total loan, the World Bank cancelled the loan for poor leadership and project oversight. However, the United Nations Development Programme funded a $500,000 grant between 2012 and 2015 to help the government of PNG develop a National Disaster Risk Management Plan.

In addition to the National Disaster Centre (NDC) and the National Disaster Committee, the government and the humanitarian community created a Disaster Management Team in response to the 2015–2016 El Niño, co-directed by the UN’s Resident
Coordinator in PNG. For this same crisis, a Food Security Cluster composed of various government agencies, church groups, and international NGOs was also established. The creation of these two entities provides some indication that the National Disaster Centre and the National Disaster Committee are incapable of dealing with nation-wide crises. In September 2015, due to what the UN Resident Coordinator thought of as inaction by the national government in making an international appeal for aid, the World Food Programme (WFP) came to PNG and conducted an initial survey of food security in the country in association with the National Disaster Centre (WFP 2016a). From this assessment, it was estimated that 2.4 million people (40% of the country) were affected by the drought and frosts, and of this number, 848,000 were severely affected.

At the provincial level, the structure of the disaster committees means that personnel who are tasked with running the day-to-day affairs of the province are pulled away from these jobs to serve on the committee. As the acting Enga Provincial Disaster Coordinator, Cleopas Roa, noted, ‘My main job is to oversee the Local Level Governments and elections, so I’m filling in really [as Disaster Coordinator]. It’s quite a task having to take several offices under my belt’ (14 Jan 2016 interview). There was also the sense that the national government was not doing enough to address the food security issue. Roa also pointed out that after the frosts hit the provincial government sent a report to the national government, but that it took over a month for the national government to respond. The national government eventually sent 10,000 bags of rice to Kandep and 6,000 bags to Laiaagam to allow the districts to allocate relief supplies, yet in Roa’s words, ‘Nothing big has come from the national government’ (14 Jan 2016 interview). The province had made two distributions of rice in two districts in Wage, the first was 20 kg and the second was 10 kg to each household. Roa estimated that the provincial government had provided aid to 12,600 households, but that it wasn’t nearly enough of an effort as the national government uses an estimate of five people per household to guide relief distributions, whereas in Enga ‘we know there are probably closer to 10–15 people per household. And what we are supplying is not enough’. He concluded by saying, ‘People are hungry. In the past, there were big migrations to other areas. Now people are having to ask wantoks to buy them rice. I don’t know what we’re going to do, it’s a problem’ (14 Jan 2016 interview).

As WFP noted about the relief effort coming from the District Services Improvement Programme, ‘It is difficult to assess the sums actually spent for drought relief’ (WFP 2016a, 6). Other district officials opined that the reason that the national government was so slow in providing money and food aid was that the government had overspent its coffers by hosting the Pacific Games in July 2015.

In February 2016, the WFP and the NDC conducted a Mobile Vulnerability Assessment and Mapping survey in which they randomly called 19 people in every LLG in the country and asked them about food insecurity (Venkat Dheeravath, personal communication, 24 May 2016). From this exercise, WFP and NDC determined that there were 1.47 million food-insecure people, but that their efforts would be concentrated within six LLGs, three of them in the Wage and Kandep area. The population in the six LLGs was estimated at 162,000 people, and including bordering regions, WFP expected to provide relief for 180,000. During the survey, they also noted that local food markets were affected – sweet potato had tripled in price, other foods had doubled, and the price of rice was up 22% (WFP 2016a, 5). From June to December 2016, WFP provided
food relief (4700 MT of rice) to over 268,000 people (WFP 2016b, 6) at a cost of around $12.5 million. WFP attempted to partner with CARE International for distribution in the highlands, ‘but in August 2016 CARE withdrew early from the partnership agreement based on security concerns’ (WFP 2016b, 8).

In addition to the World Food Programme and CARE International, there were other aid agencies that came to Enga Province in 2016 due to the food crisis. The International Organization for Migration (IOM) oversaw the distribution warehouse where rice and other food stuffs were stored in Wabag, but had primary goals other than food aid delivery. One of the IOM staff (from Southern Highlands Province) in Wabag, stated that:

We [IOM] don’t usually operate in the highlands due to security concerns. Our main areas of concern are drilling water bores in areas most affected by drought. But culturally, people here don’t like to drink water that isn’t flowing from a spring. We are also promoting sustainable food practices and crops. We want people to think about storing food, so we are promoting corn (Zea mays), but they don’t want to subsist on it. They don’t store meat either. Because of their culture, they only think of the present. The biggest challenge though is getting people to understand what the actual mission of the agency is. We are working on the water bores and people come up to us and tell us to fix the roads or deliver rice, but those aren’t the project we are working on. (14 Jan 2016 interview)

The disdainful attitudes about local cultural beliefs and practices that the IOM staffer attributed to Engans also played out among the international NGO personnel. In May 2016, two aid workers from an international NGO invited my research assistant and me to feast on a goat that they had just purchased from a local family. Initially, I couldn’t stomach the irony of having a feast in the midst of a food crisis, but eventually rationalised it by realising that the family that sold the goat would now be able to purchase much-needed food. When we arrived at the feast, an aid worker from another NGO immediately started criticising the two other aid workers, claiming that ‘they know nothing of PNG, they haven’t even been in the country for six months.’ He also accused the aid workers of naivety by ‘believing the locals that people are dying from starvation in the highlands’ (on debates about starvation, see Wohlt et al. 1982; Allen, Brookfield, and Byron 1989). What this vignette depicts is the levels of miscomprehension of disasters and vulnerability at the international scale. The one aid worker used claims to knowledge about PNG to adamantly deny the scope of the food crisis by indicating that highlanders were using the crisis to gain access to freely distributed rice. The irony of the situation with the two other aid workers is while they were convinced of the severity of the crisis, they were simultaneously feasting on goat in the midst of it. By the end of 2016, the food security crisis had ended. WFP had made distributions to individuals, not households, which greatly reduced the burden of feeding large households. In the next section, though, I want to examine how vulnerability and food insecurity were both produced and mitigated at various scales.

**Conclusion: Producing and Mitigating Vulnerability**

As mentioned above, following the 1972 El Niño, the Australian colonial government promoted the growing of Irish potatoes which are frost tolerant and mature in three to six months versus the nine to twelve month maturation time of sweet potato. Following the 1982 and the 1997–1998 El Niños, the Irish potato was one of the important food crops
that helped to mitigate food insecurity. However, a potato blight that entered the Wage and Kandep region in 2003 has prevented the growing of Irish potatoes in this area (Jenny Dilly, 19 Jan 2016 interview). According to interviews and garden inspections in 2016, only two cultivated crops survived the drought and frosts in Wage – cabbage and some varieties of beans (Phaseolus vulgaris). Most people did not have enough beans planted to provide more than a few meals, and so cabbage was the main food that people ate before international food aid relief arrived. Many people also reported going into the rain forest to harvest tree fern leaves to eat, too. Dependence upon a cabbage diet, however, inhibits iodine absorption and poses various health risks (goitre, impaired mental functions, and so forth) falling under the rubric of iodine deficiency disorder (Delange 1994; see also Hetzel 1983).

There were two other factors at the local level that produced vulnerability among affected households. The first of these was the sale of pigs. Many people commented on the fact that during the food crisis they resorted to selling pigs to raise cash for food purchases. However, due to the crisis, buyers knew that sellers were desperate and offered much lower prices than the pigs would typically have fetched. Not having access to a nearby road also inhibited many of the more remote people from even being able to sell their pigs for a reduced price. The second factor was tribal fighting. As indicated, people from Wage and Kandep mentioned the tribal fighting in Porgera as one of the main reasons they were reluctant to attempt to migrate there. Local tribal fighting related to provincial election outcomes also affected food production in that a Chinese-funded wheat flour mill that had been constructed in 2000 (as a means to reduce food insecurity and introduce a more frost resistant and storable crop) had been burned down a few years before the 2015–2016 El Niño arrived. Both Ben Wesawa, Kandep District Administrator (19 Jan 2016 interview), and Tamar Amean, Wabag director of IOM (14 Jan 2016 interview), noted that had the mill not been destroyed and wheat production halted, there could have been enough wheat flour available to provide food aid.

Vulnerabilities were also produced in interactions between provincial and national government institutions. Provincial officers complained that when the national government finally did send food aid, they did not provide the means to get the food to the affected areas and left the logistical details of delivering thousands of bags of rice to provincial and district authorities. As well, the insistence by the national government that a household is composed of five people, when that clearly is not the case in Enga Province, meant that standard distributions of rice and food aid were not enough to forestall food insecurity. Households were thus treated as uniform by the government when they each had very different assets, capabilities, and vulnerabilities in terms of accessing food (compare Sen 1981). Regionally, church groups may have contributed to both mitigating and producing vulnerabilities. Following the frost events in August 2015, many church groups brought bags of sweet potato cuttings to Wage and Kandep so gardens could be replanted, but then there were some reports that they were only provided the cuttings to the members of their own congregations according to several interviewees. However, church groups were also instrumental at the national level in mitigating vulnerabilities.

Finally, at international scales, vulnerabilities were both mitigated and produced. The PNG government’s failure to seek food aid from international aid agencies certainly exacerbated the food insecurity problem which was only rectified when the UN and WFP intervened. Similar to Waddell’s (1975) claims that colonial agents saw migration as an
unstructured response to disaster, as discussed in the previous section, there was miscom-
prehension of the severity of the crisis by international aid workers, which resulted in one 
NGO pulling out of the relief efforts altogether due to safety concerns over operations in the 
conflict-ridden highlands. Finally, the role of capitalist resource development needs to be 
factored in to how vulnerabilities are produced and mitigated. On the one hand, cash 
incomes from businesses, wages, and wantoks were used by impacted and non-impacted 
individuals in PNG to buy rice and other foodstuffs to mitigate food insecurity for the 
food insecure people. On the other hand, the nature of resource compensation in PNG 
creates income inequalities within and between communities that frequently erupts into 
violence over the breakdown of exchange-based societal mechanisms to distribute wealth.

As I have argued in this article, the production of vulnerability is a multi-scalar 
phenomenon. Following the 1972 and 1980 frosts that impacted high altitude-dwelling 
Engans, both Waddell (1975) and Wohlt et al. (1982, 68) critiqued the efforts of the inter-
national aid community, with the latter writing that ‘We believe international food aid 
should be used rarely, and only in the most extreme circumstances’. At the time of 
their publications, customary mechanisms of adaptation were still extant. In fact, even 
during the 1997–1998 El Niño extraregional migration was an option for most of the 
people living in Wage and Kandep. In the intervening years, however, development and 
population pressures on land, an increasing market economy that erodes customary 
exchange mechanisms, and increases in intergroup violence have attenuated the social net-
works and customary mechanisms that people depended upon in past El Niño-caused dis-
asters. The challenge that all of the entities at various scales of governance and assistance 
face is building adaptive capacity at the local level. As one of the staff from one of the major 
aid NGOs stressed to me, ‘We’re trying to build more resilient communities, to ensure the 
sustainability of the projects. But we are also telling the people that we won’t be here for 
the next El Niño, they need to take ownership of these projects at the local level’. As 
stressed in this article, however, vulnerability is not just produced at the scale of the 
local level. An attention to the political ecology of vulnerability – the differences in 
access to and control over resources playing out at multiple intersecting scales – stresses 
that these are complex yet comprehensible processes.

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