

Suggestions to improve livelihoods in remote lowland communities in Western Province and Southern Highlands Province, Papua New Guinea

Matthew'wela B. Kanua and R. Michael Bourke

Abstract

We surveyed subsistence food production and cash income from agricultural sources in 30 villages along a 250 km traverse in Western Province and adjacent locations in Southern Highlands Province. Most (27) of these communities are remote with no road access. Here we make suggestions on how food production could be improved and cash income from agricultural sources increased in these remote communities. More efficient food production is likely to provide multiple benefits, including increasing food security and reducing labour inputs into food production. Greater cash income is likely to improve child nutrition, increase food security, allow people to pay school fees and purchase basic agricultural tools and inputs, including household items.

Suggestions to improve livelihoods in remote lowland communities in Western Province and Southern Highlands Province, Papua New Guinea

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1. Introduction

Support for agricultural development and villagers' livelihoods in Papua New Guinea (PNG) is generally given to those living in better physical environments and where villagers have greater market access. In this paper we focus on the rural villagers living in remote parts of Western Province and adjacent locations in Southern Highlands Province. Even by the standards of rural PNG, the areas of focus are remote, with fit young men needing to walk for two to six days to reach an urban area. Many older women and some older men have rarely, if ever, been to an urban area.

There are fewer opportunities in these locations for villagers to market agricultural produce and people receive less assistance from outside organisations. This contrasts with communities in Western Province living on the Kiunga-Tabubil road, along the Fly River, and others in the Ok Tedi Community Mine Continuation Agreement (CMCA) corridor.

Child malnutrition is high in Western Province, particularly in parts of the province that we cover in this paper, as it is in nearby parts of Southern Highlands Province. Improving food security would enhance the nutritional status of villagers, particularly children and women (Stephenson & Lowagipo, 2021). Improved techniques for growing food have the potential to reduce labour, particularly benefitting women. Greater cash income benefits villagers, by helping to:

- improve child nutrition (Heywood & Hide, 1994)
- facilitate purchasing food when subsistence production is inadequate
- improve lives through purchases of basic items such as soap, salt, cooking oil, fishing equipment, torches and batteries
- pay school fees
- purchase basic agricultural tools and other agricultural inputs.

In 2013 and 2014, we participated in a social impact assessment and socio-economic study for the proposed P'nyang Liquefied Natural Gas (LNG) project in parts of Western Province and adjacent locations in Southern Highlands Province of PNG (Goldman 2014a, 2014b). Village subsistence food production and cash income from agriculture were surveyed in 30 villages near the proposed gas wells and gas pipeline route.

Most of the villages that we surveyed (27 out of 30) were remote with no road access (Figure 1). Some had access to Kiunga by river, but the cost of fuel for outboard motors prohibits most trade. Thus, market access is poor to extremely limited. Villagers have very little cash income (Bourke & Kanua, 2022; Bourke & Kanua, in press; Kanua & Bourke, 2021). Despite market access limitations in these remote locations, several simple interventions could be promoted to improve the lives, livelihoods and wellbeing of villagers.

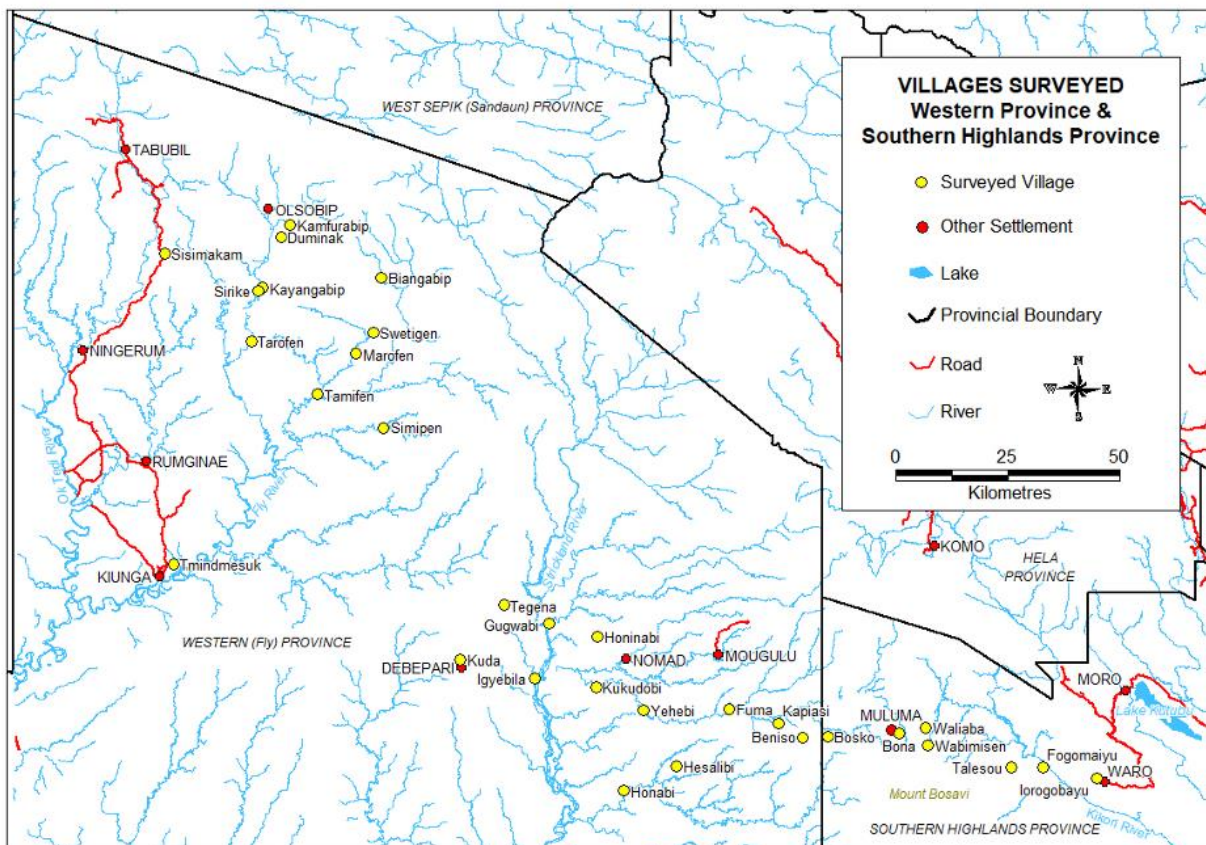
Building on observations and data collected in the 2013 and 2014 P'nyang LNG project social impact surveys, we outline how food security and village agriculture could be improved to benefit villagers in this region. Our suggestions are also informed by changes since our field surveys. Many of the changes in the area have been facilitated by interventions by the Ok Tedi Development Foundation, PNG Sustainable Development Program Ltd, the Roman Catholic Diocese of Daru-Kiunga, North Fly Rubber Ltd, Strickland Bosavi Foundation and The Rotary Foundation.

In February 2022, the PNG Government signed an agreement to move forward with the proposed development of the P'nyang LNG project, with construction to start in 2024 (Business Advantage PNG, 2022). In a statement, ExxonMobil said that the project would 'support job creation in Western Province and other involved provinces, with the PNG workforce and local businesses benefitting from economic opportunities as well as training and skills development programs' (ExxonMobil, 2022). The LNG project provides an opportunity to improve the livelihoods of rural villagers, at least near construction sites and the pipeline route for that project.

2. Research methods and data

We obtained information on sources of subsistence food, of both plant and animal origin, and on sources of cash income in the 30 villages surveyed on four trips to Western Province and Southern Highlands Province in 2013 and 2014 (Figure 1). We also noted the physical environment, transport options and market access in each location. For the first three trips in May, July and October 2013, village surveys were conducted in daily visits. In the survey of the final 12 villages in July 2014, we were able to stay overnight in villages, spending between one and five days per village. Survey techniques are described in more detail in Kanua and Bourke (2021), including a discussion on the limitations of the techniques used. Information on the altitude, population in 2013, main language spoken and the main staple food crops for each village is also summarised in that paper (Kanua & Bourke, 2021, Table 1, p. 4).

Figure 1: Surveyed villages, urban centres and other settlements in Western Province and Southern Highlands Province, Papua New Guinea



Map produced by Dr Michael Lowe

In each village, we explained our work at a meeting and asked open-ended questions about food production, consumption and cash income. After the initial meeting and discussion with villagers, we visited food gardens up to several hours' walk from the village, talking with the village guides. The observations reported in this paper are a form of rapid rural appraisal. Our prior experience in describing village agriculture during rapid surveys in PNG, and previous experience in working in these two provinces, meant that we could capture much relevant information in a brief period. Nevertheless, there are limitations to what information can be recorded accurately in a relatively short visit to a community, with most visits to villages done in one or two days.

Suggestions on how subsistence food production and human nutrition could be improved are based on our extensive experience with addressing these issues elsewhere in PNG, including in the successful Community Livelihood Improvement Program of the PNG LNG project (Bourke et al., 2019). Information on possible cash crops also builds on our past experience. Helpful additional information on eaglewood, vanilla, rubber and other products was provided by staff from the PNG Sustainable Development Program, Catholic Diocese of Kiunga-Daru, North Fly Rubber Ltd, Ok Tedi Development Foundation, World Wide Fund for Nature, Strickland Bosavi Foundation, Rotary Foundation and others (see Acknowledgements).

The study area extended from communities southeast of Tabubil township in Western Province to those southwest of Lake Kutubu in Southern Highlands Province (see Figure 1). Our traverse extended over a 250 km linear distance, roughly in a southeast direction. Four villages in the northwest of our traverse were located in the foothills of the main ranges (330–600 m altitude); eighteen villages were at lower altitudes (40–160 m, with one village at 330 m); and the final eight villages in the southeast of our survey were at somewhat higher altitude (440–660 m). The entire area is forested. Rainfall is high (4000–7000 mm/year on average) and soils are generally infertile. Population density is low to extremely low.

3. Findings

In this section, we first make suggestions regarding cultivation and preparation of subsistence food. These proposals have the potential to improve subsistence food production and human nutrition, as well as to reduce labour inputs.

Then we examine some options to increase villagers' cash income. Cash income from agricultural pursuits has improved the nutritional status of children and reduced child mortality elsewhere in PNG (Heywood & Hide, 1994). Transport and marketing constraints currently limit opportunities to sell agricultural produce for most villagers in remote parts of the study region, thus reducing possibilities to improve people's income and hence their welfare. Nevertheless, there are some options for greater production of higher value crops that can be transported by air. There is greater potential for increasing cash income from crops and animals if access to urban centres improves with better transport links.

3.1 Subsistence food

3.1.1 Energy dense foods

Greater consumption of foods rich in oil, particularly coconuts, *marita* (*Pandanus conoideus*) and peanuts, would improve nutrition for both children and adults. We noted coconut palms in most of the remote villages visited. Palms were generally limited in number as coconuts were rarely grown in the remote parts of lowland Western Province and Southern Highlands Province until about 50 years ago. Coconut palms continue to produce energy-rich nuts in severe droughts and hence provide valuable food when arable crops fail. We suggest that planting more coconuts should be promoted in these villages. *Marita* pandanus is widely grown in the region and we recorded it being grown in all 27 remote villages surveyed. Peanuts were grown in limited quantities in about half (13) of the surveyed villages, mostly near and east of the Strickland River. Greater consumption of these and other foods with a higher oil content should be promoted in nutrition programs.

3.1.2 Superior cultivars of existing food crops

Most food crops that are suitable for planting in these remote lowland locations were grown traditionally or have been introduced over the past 50 years. Improved cultivars (varieties) of crops from other locations in PNG such as sweet potato, cassava, open-pollinated corn (maize), yam, peanuts, rice, guava, mandarin, orange and various vegetables are available (National Agricultural Research Institute, 2013).

We noted African yam (*Dioscorea rotundata*) planted in only one village in Western Province. This food crop would enhance diets (Risimeri et al., 2001) and planting material could be widely distributed. The Kalapua banana cultivar has been adopted in some of the villages in the Mt Bosavi area in Southern Highlands Province. This hardy cultivar bears well, even under low soil fertility conditions, and is drought tolerant. Again, we suggest that banana planting material should be distributed more widely in this region.

Sweet potato has become the most important food in the mountainous part of this region — that is, in villages in the northwest of our traverse (Kanua & Bourke, 2021). It is also being grown more often in communities in the southeast of our traverse in the Mt Bosavi area. There, sweet potato is grown as part of a package of technologies influenced by Highland practices, including the construction of deep Huli-type ditches, the creation of home gardens and planting the crop in large plano-convex mounds with incorporated organic matter. The introduction of vigorous pathogen tested (low virus) sweet potato planting material, which is available in some rural locations in the Wahgi and Asaro valleys, is suggested.

Distribution of superior cultivars of food crops from research institutes or local sources is a relatively low-cost way to improve food production and would be a high priority for agricultural development programs.

3.1.3 Food processing

Training women in baking was a successful component of the livelihood program of the PNG LNG project in the Hides and Komo areas west of Tari in Hela Province and the Moro and Lake Kutubu areas in Southern Highlands Province (Bourke et al., 2019). This

involved facilitating the formation of women's groups, distributing ovens made from discarded 200-litre fuel drums and training women (and some men) in food processing, hygiene and human nutrition. Women learnt to prepare a range of baked foods, including buns, muffins, cakes and scones made from a mix of locally grown and imported ingredients, as well as chicken. The women were also trained in cooking more nutritious and tasty meals for their households and the 'one pot' cooking method was widely adopted.

We did not hear of women baking food for sale in the surveyed villages. It is possible that this is done occasionally, but it is certainly not common and no drum ovens were noted in villages. Given that baking food products and selling them locally was adopted successfully in similar environments, particularly in the Lake Kutubu area, we anticipate that there is potential for this to be adopted in the remote lowland locations.

Training women in preparing more nutritious and tasty meals can potentially improve the nutritional status of children and adults, particularly if done in conjunction with basic training in human nutrition and hygiene. Providing drum ovens and baking trays and training women in baking food for sale locally has the potential to increase their income. Given the limited amount of cash circulating in these remote communities, the potential to increase income is limited, but even small amounts of cash income can improve women's lives.

Such training does require specialist experienced trainers and requires inputs over several years to reach many communities. We suggest that it is a high priority input, provided that resources could be found to support this.

3.1.4 Home (kitchen) gardens

In communities in the Mt Bosavi area in Southern Highlands Province, people have adopted home gardens as part of their food production practices. These are located close to settlements and a deep Huli-type ditch or a fence surrounds the settlement and home gardens to protect crops from damage by pigs. Many types of food crops are grown in these gardens, with sweet potato being the most important. Soil fertility is maintained by

the addition of household waste to the soil surface, planting nitrogen-fixing leucaena trees and placing organic matter in large mounds ('composting' is the term used in PNG for this practice). It appears that these practices are increasing food supply.

The use of home gardens is increasing in importance in the Mt Bosavi area, possibly in response to population increase, greater stability in village locations and as part of broader social and economic change in this subregion. Adoption of home gardens where sweet potato is an important component of the garden may be a useful strategy in other communities in the broader region. This is because of high productivity of sweet potato, particularly when grown in composted mounds; the ready access to a range of nutritious vegetables from home gardens; and the protection of crops from damage by pigs that the ditches or fences provide.

Adoption of home gardens has been done as villagers observe techniques used by Highland people living in the area over a long period. Promotion of adoption of home gardens is a longer-term project and may be less successful in locations at lower altitudes (50–450 m) as the added organic material will break down faster at higher temperatures.

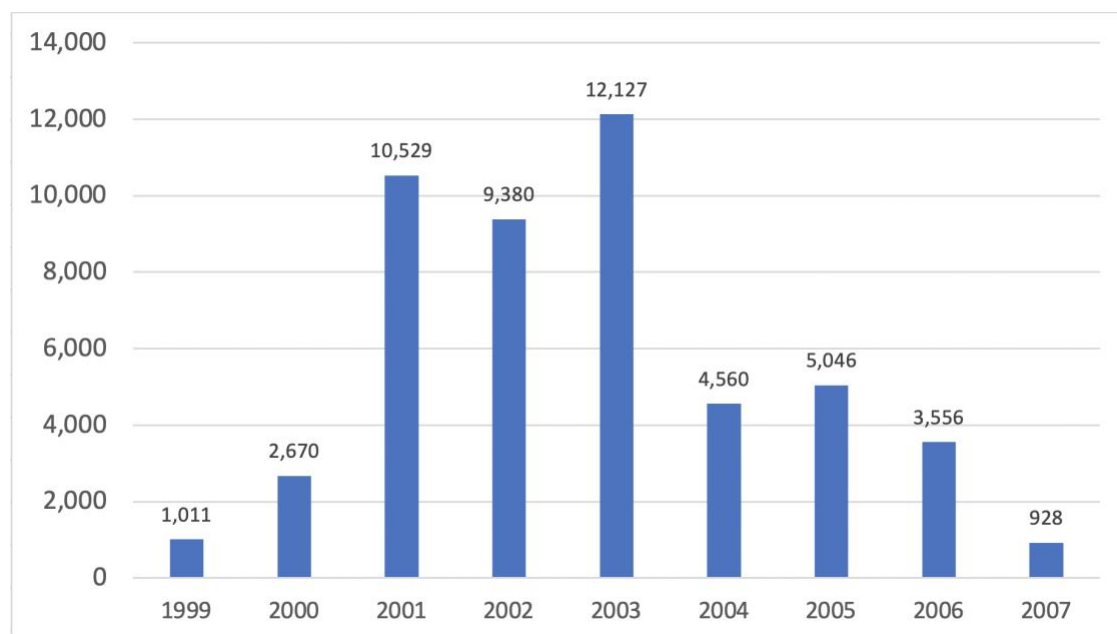
3.2 Cash income from agriculture

3.2.1 Eaglewood

The eaglewood tree (*Gyrinops ledermannii*) is a promising source of cash income in much of this region (Biza, 2007; Gunn et al., 2004; Katapa, ca 2012; Piafu et al., 2005). Self-sown eaglewood trees grow in the forest up to 400 m altitude in some remote locations of Western Province and Southern Highlands Province. The tree tolerates a wide range of rainfall (1700–5200 mm/year). Currently only 2% of self-sown trees produce agar, an aromatic resinous wood used for religious and medicinal purposes, and trees are destroyed in the process of removing it. Agar, the economic product, has a high value per unit weight, and it is thus well suited to remote locations where transport is expensive and unreliable. Many self-sown trees in PNG were destroyed during the boom production years in the early 2000s (Figure 2). Very limited amounts of eaglewood have been collected (and occasionally sold) in the remote survey villages. We noted the

presence or absence of self-sown trees and past interest in the sale of agar in each village (Appendix Table A1).

Figure 2: Exports of eaglewood agar from Papua New Guinea, 1999 to 2007 (kg)



Source: PNG Forest Authority, published in Bourke and Harwood (2009, p. 398)

A project, supported by the PNG Sustainable Development Program, Ok Tedi Development Foundation and the Catholic Diocese in Kiunga, imported a species of eaglewood (*Aquilaria crasna*) from Vietnam that produces higher yields of agar. This project has promoted planting small orchards of these trees and artificial inoculation of trees to increase the yield of agar in some CMCA villages. It is estimated that about 500,000 trees have been planted. Yields of about 1 kg of agarwood per tree are being achieved where trees have been artificially inoculated with the appropriate fungus, thus giving a return to growers of PGK100–150 per tree (Ian Middleton, personal communication, November 2021). At the time of our survey, however, there were no such trees in use in the remote surveyed villages and we understand that this is still the situation.

Given the success of eaglewood cultivation in the CMCA area, and the similarities between that area and the more remote communities in the study area, we believe that eaglewood has considerable potential for income generation for remote locations. This is

because the high value of the agar means that it can be transported economically by air, particularly if superior trees are planted and trees are artificially inoculated to increase the yield of agar.

3.2.2 Vanilla

We noted small plots of vanilla in some villages, but this was rarely marketed in 2013–2014 (Table A1). In the past eight years, a lot more vanilla has been planted and processed beans are now sold. In 2021, vanilla prices were sufficiently attractive for processed beans to be airfreighted from remote locations to Kiunga in Western Province. The optimum annual rainfall for vanilla production is 1700 to 2500 mm, with two drier months to induce flowering (McGregor, 2004), much lower than the 4000–7000 mm/year received in the central and northern parts of Western Province (McAlpine et al., 1975). Nevertheless, vanilla is producing well in the Strickland-Bosavi subregion, especially when hand pollinated. Fly Vanilla Ltd, a Kiunga-based subsidiary of WestAgro Holdings, plans to purchase and process green vanilla beans from mid-2022. They also plan to purchase processed beans, including from locations where it is not possible to sell green beans (Loop PNG, 2022).

Thus opportunities to market vanilla beans from remote locations should improve in the near future. Optimum curing for high-quality (Grade A) beans ensures the best price. Training of specialist processors and in-field hand pollination may be required. Some growers in the province have this expertise and could be employed to train other specialist processors.

3.2.3 Rubber

Rubber has been a successful cash crop in the western and southern parts of Western Province in the Ningerum-Kiunga to Lake Murray region and near Balimo, with support from a Kiunga-based business, North Fly Rubber Ltd. Some rubber trees have been planted in the past in some communities surveyed, particularly in the Debepari area (Appendix Table A1). However, lack of road access limits the potential in the more remote parts of the province (see Figure 1). A road from Kiunga east to the Strickland River via

Iowara has recently been made, apparently to facilitate logging of native forest. If this were upgraded to an all-weather road, it would provide the opportunity to some communities to market rubber from existing stands, as well as other agricultural products.

Returns from labour inputs on rubber are not as attractive as many other cash crops (Bourke & Harwood, 2009, pp. 411–414). This limits the attractiveness of rubber as a cash crop when other options are available that give higher income per unit of labour input. Thus promotion of rubber planting should be done cautiously as higher value crops such as eaglewood and vanilla may be more attractive to villagers.

3.2.4 Cocoa

There is virtually no cocoa currently produced in Western Province or Southern Highlands Province (Bourke & Harwood, 2009, pp. 555–556). WestAgro Holdings plan to promote cocoa production in some CMCA corridor villages with an Agro-Industrial Centre at Suki in the South Fly District (WestAgro Holdings, 2021).

The optimum annual rainfall for cocoa in PNG is 1800–2600 mm, with production greatly reduced where rainfall exceeds 5000 mm per year (Hanson et al., 1998). Thus, in the past cocoa has been unlikely to yield well in most of the remote locations covered in our survey where rainfall is very high.

Cocoa is currently being grown at higher altitudes than it was in past decades in PNG, with some plantings as high as 1500 m in the central Highlands. This is partly because of increasing temperatures associated with global climate change. It also reflects the wide genetic diversity of cocoa in PNG (Philip Keane, personal communication, June 2018). Clones are available that can produce pods in a wide range of environments. Hence, it is possible that clones could be selected that would bear even under the very high rainfall conditions in lowland areas of Western Province and Southern Highlands Province. It would be worthwhile distributing a range of cocoa clones from Tavilo Cocoa Research Station in East New Britain for evaluation in both the lowlands and mountainous parts of Western Province and Southern Highlands Province. We suggest that cocoa should not be

promoted in these remote lowland locations until both production and marketing issues are addressed, given the lower confidence that it might become a successful industry.

3.2.5 Fresh food

Villagers sell fresh food and animal products in small village markets in the study area, with limited amounts taken to Kiunga for sale (Appendix Table A1, Table A2). Some people grow and sell peanuts in distant markets, particularly from the Nomad-Mougulu area. However, the long walk to markets, or expensive air fares, means that it is not practical for most people in this region to market fresh food in urban markets.

There are some opportunities to market fresh food in remote parts of Western Province, but this is severely constrained by low cash income of potential buyers, and by environmental factors. Even small increases in sales of fresh and of processed foods would be useful, particularly for women, most of whom have limited cash income with which to buy basic items such as cooking oil and fishing equipment. An expanded road network would enhance the sale of peanuts and other fresh food in urban centres.

3.2.6 Betel nut and betel pepper

Production of betel nut and betel pepper provides cash income to people in many lowland communities in PNG, as does long-distance trade of these two products to urban centres and the Highlands (Sharp, 2016). Betel nut was not commonly consumed in this region in the past, but palms have been planted in recent decades (Appendix Table A1). Given the limited local production and high cost of transporting nuts from other parts of PNG, betel nut commands a high price in urban markets in this region (Bourke & Kanua, 2022). Some betel nut is marketed from communities closer to the roadhead in the southeast of the study area. If more betel nut was planted, greater quantities could be sold by communities with river or road access to urban markets, including Kiunga in Western Province, and Moro and Mendi in Southern Highlands Province.

3.2.7 Other possible cash crops

WestAgro Holdings is exploring some other possible cash crops for the CMCA corridor, including black pepper, bixa (annatto) and *okari* nut (*Terminalia kaernbachii*). We recorded *okari* nut being grown in all 27 remote villages surveyed. If these products could be marketed so as to give an attractive rate of return, they may have potential as cash crops in more remote parts of Western Province and nearby areas.

3.2.8 Animal products

Using local feed sources, such as sweet potato and cassava, to feed pigs, poultry and fish is technically feasible, provided that these locally grown foods are supplemented with other food, such as commercial broiler or pig concentrates (Dom et al., 2014). In these remote locations, livestock production is limited by the availability and high transport costs of high protein stockfeed. Nevertheless, production of chickens and ducks for meat and eggs may be achieved if cheaper feed options using local foods are developed and if ongoing advisory support is provided.

Income from the sale of animal products, including game meat, dried fish, cassowaries, piglets, bush fowl and cassowary eggs, and crocodile skins, is limited and sporadic (Appendix Table A2). Most is sold within the community or in nearby communities, except for crocodile skins and some game meat sold in Kiunga and other centres. Increased sales depend on improved road or river transport.

4. Conclusions

Our focus in this paper has been on suggestions to improve food production and cash income from agricultural sources in remote lowland communities in Western Province and Southern Highlands Province. However, many of these suggestions are relevant to remote and disadvantaged communities in other parts of Papua New Guinea.

Improved planting material and other technologies could be promoted to improve villagers' livelihoods through increased food production, reduced labour inputs and improved nutrition. Remoteness and poor market access limit what can be sold

profitably, but even small increases in cash income can improve villagers' lives and should be pursued.

Ways to enhance food supply include promotion of greater production and consumption of energy dense foods, including coconuts, *marita* pandanus (*P. conoideus*) and peanuts; introduction and distribution of superior cultivars of current food crops; training women in improved cooking techniques and cooking certain processed foods; and possibly more widespread adoption of 'home' gardens adjacent to settlements.

Cash income is limited in these remote communities by the absence of road access to urban centres. Depending on market access, greater cash income could be derived by production and sale of some combination of eaglewood, vanilla, rubber, cocoa, fresh food, cooked food, betel nut, poultry, fish, cassowaries, piglets and crocodile skins. Given current transport linkages to urban centres, prices and marketing arrangements, the cash crops with the greatest potential for expanded sales in the short to medium term are eaglewood and vanilla, with smaller volumes of betel nut, fresh food and cooked food. There is potential for greater sales of animal products, but it is dependent on improved transport links to locations where they can be sold, most of which are urban centres.

Some of the innovations adopted by villagers in the southeast of our traverse in recent decades have contributed to increased food security and could be promoted in other communities. The lives of villagers in remote locations could also be improved if they received training in financial literacy, basic hygiene and human nutrition.

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Appendix

Table A1: Number of communities where potential cash crops were recorded as present and where they were sold in 27 remote communities in Western Province and Southern Highland Province in 2013 and 2014

Commodity	Commodity present	Commodity sold
Fresh food ^(a)	27	16
Betel nut ^(b)	27	4
Eaglewood ^(c)	14	0
Rubber ^(d)	7	1
Vanilla ^(e)	3	0
Robusta coffee ^(f)	2	0
Chilli ^(f)	2	0
Cardamon ^(f)	1	0
Cocoa ^(g)	0	0

Source: Kanua and Bourke (2021)

Notes:

(a) Fresh food was almost certainly sold in more than 16 of the 27 communities surveyed. The volume sold in all communities was limited.

(b) Betel nut was recently adopted or grown in very limited quantities in half (13) of the 27 remote communities surveyed. It was more established in communities near the Strickland River in Western Province and east of there.

(c) Eaglewood was recorded in 14 of the 27 remote communities but was almost certainly present on the land of more communities. In Western Province, in Kayangabip Village, people said that some agar was extracted and given to a buyer, but he did not pay for the agar. In Biangabip Village, some samples were taken by some outsiders, but no sales were made. Villagers in Honabi had harvested an estimated 200–300 kg of agar but had not sold this when we visited in mid-2014.

(d) Rubber was planted in 7 of the 27 remote villages surveyed. It was planted in the 1960s/1970s in four communities and in another three villages in about 2009. Some rubber was sold from communities in the Debepari area in Western Province in 2013 but in limited volume as it was being flown to Kiunga as a backload on occasional charters carrying trade store goods to Debepari.

(e) Vanilla had been planted recently in three communities when we visited in 2013–2014. Since then, more vanilla has been planted in many communities and some is being sold.

(f) Some Robusta coffee, chilli and cardamon had been planted in several communities many decades ago, but the produce was not harvested or sold.

(g) No cocoa was seen in villages in 2013 and 2014.

Table A2: Number of communities where animal products were recorded as being sold in 27 remote communities in Western Province and Southern Highlands Province in 2013 and 2014

Animal product^(a)	Commodity sold
Game meat	14
Fish (smoked/fresh)	9
Cassowary	6
Pigs (piglets/large)	6
Cassowary eggs	4
Pig meat	4
Crocodile skins	4
Bush fowl eggs	2
Dog (pups)	2
Chickens ^(b)	0

Source: Kanua and Bourke (2021)

Notes:

(a) Some animal products, including game meat, fish and pigs, were probably sold in more communities than recorded here.

(b) Chickens were recorded in all 27 villages surveyed, generally in limited numbers. However, nobody mentioned selling them.