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Poor rural places in Papua New Guinea

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Abstract: *In the late 1960s, Harold Brookfield and Doreen Hart were 'startled' by the order of magnitude differences in incomes from village cash cropping in different parts of Papua New Guinea (PNG). This paper traces these differences, back into a pre-colonial past and forward to the present and concludes, as Brookfield did in the 1960s, that severe environmental constraints, rather than market forces, are the primary cause of the pattern of spatial inequalities observable in PNG. Brookfield noted the existence of an 'acute dilemma' in 1960s development funding: should funds be invested where the returns will be highest, or where the need is greatest. This dilemma is as acute today as it was then. However, in the meantime, people from poor places are moving to better-off places, seeking access to markets for their produce and health and education services for their families.*

Keywords: *Papua New Guinea, environment, poverty, development, migration*

A World Bank poverty survey in Papua New Guinea (PNG) in1996 found that up to 40% of people are living in poverty (Gibson, 2000). Twenty-five years earlier Harold Brookfield with Doreen Hart, in their exceptional regional overview *Melanesia: A geographical interpretation of an island world*, had written of rural development in PNG:

> Underlying these [development] schemes was a policy aim . . . of spreading development more widely . . . . In East New Guinea [PNG] this policy became tagged with the rather unfortunate label 'uniform development'. . . . Despite these policies however, development is very far from uniform . . . . [There exists] a background of widely varying levels of participation in the cash economy, and trends in population and development which exhibit great contrasts. (Brookfield and Hart, 1971: 237–238).

They concluded that the cause of this 'differentiation' was that in PNG rural development was closely linked to export production and that 'export production is sensitive in its ecological requirements' (Brookfield and Hart, 1971: 309). In other words, development in PNG was closely associated with environments.

We return to their conclusions at the end of this paper. It is sufficient to say at this point, however, that they identified an 'acute dilemma' in the development of rural PNG, which remains as acute today as it was in 1971. The dilemma is whether to invest scarce development funds into areas of high land potential where they are likely to deliver the greatest returns, which are already the best developed areas, or, whether development funds should be invested into the poorest areas, in an attempt to assist them to catch up with the better-off areas.

In this paper we examine further the argument of Brookfield and Hart that development in PNG is closely associated with export production and that export production is in turn influenced by environmental conditions. We agree with them and argue, against well-accepted premises, that underdevelopment and poverty in PNG is the not the outcome of unequal market forces but is primarily the outcome of environmental conditions that prevent people from engaging with global and domestic markets. PNG's environment (rugged mountains, high rainfall, large rivers and extensive swamps) means that the country suffers from a fragmented transport network where travelling times to transport

infrastructure are unusually large.[1] As a result, the lives of the poorest people have changed little from the way their predecessors lived prior to the advent of colonialism, capitalism and the cash economy. We further suggest that the same environmental conditions that cause poverty today were the cause of significant pre-colonial inequalities in agricultural production and human nutrition in PNG.

There are at least three reasons for a wider interest in poverty in PNG. First, there is widespread access to land through customary land ownership. This seems to count against one explanation for persistent rural poverty – that it results from lack of entitlement to crucial assets such as land (see Bogale *et al.*, 2002 for this claim in rural Ethiopia). Second, many of the areas that are currently identified as poor in PNG were identified as poor 30 years ago, beginning with Brookfield and Hart's study. This persistence in the pattern of poverty is difficult to explain with standard economic models that see poverty as resulting solely from poor endowments of human capital and other household resources. Such models explain poor areas by arguing that people with poor endowments tend to live together, which has the implication that anti-poverty interventions should target non-geographic attributes. However, evidence from other countries, such as Bangladesh (Ravallion and Wodon, 1999), suggests that there are geographic effects separate from household and personal characteristics that contribute to persistent poverty. The evidence from PNG is supportive of this claim. Third, PNG appears to provide support for the proposition that basic infrastructure investments in a developing country would be effective in reducing poverty (van de Walle, 2002). We find, however, that the construction of roads into poor areas in PNG is unlikely to occur and that poor people are of their own accord, moving to areas with better prospects.

Papua New Guinea

During the last flourish of nineteenth century colonial land grabbing, the island of New Guinea was divided into three zones (Moore, 2003). By 1900 the western end had become part of the Dutch East Indies. North-east New Guinea and the Bismarck Archipelago had become a German colony with an administrative headquarters in Rabaul and the south-east a British colony which in 1906 became the Australian Territory of Papua, administered from Port Moresby. In 1914, Australia invaded the German colony and in 1921 it became a League of Nations Mandate to Australia. New Guinea and Papua were administered separately by Australia until the Japanese invasion in 1942, when they were placed under a single military command with a headquarters in Port Moresby. After the war Papua and New Guinea was administered by Australia as a single territory until it gained self-government in 1973 and independence in 1975 as Papua New Guinea. Provinces and locations of Papua New Guinea are shown in Figure 1.

In both the German and the British colonies, after failures with field crops, the production of copra from existing village plantings and newly established plantations become the most important economic activity. Labour was brought to the plantations under indenture systems. Gold mining by foreign miners occurred in both colonies but only in pre-war New Guinea were large amounts of capital invested into dredges and underground workings, such that by 1942 New Guinea was a much wealthier and better developed colony than Papua. In 1966, the first complete PNG census counted 2.15 million inhabitants. By 1980 there were 3.03 million and 5.2 million in 2000. Around 83% of people live in rural areas. Only Bhutan, Burundi and East Timor have a greater proportion of people living in rural areas than PNG (United Nations, 2003).

Contrary to popular opinion, PNG is not particularly well endowed with natural resources. It is a mountainous country; 52% of the total land area is classified as mountains and hills and 48% of the population live on mountains or hills (McAlpine and Quigley, n.d.). Less than 1% of the total land area is classified as 'very high quality land'[2] and almost 60% is classified as 'low' or 'very low' quality land (Hanson *et al.*, 2001: 298). Poor quality land is higher, steeper, has higher rainfall, floods more often, is cloudier and has less fertile soils than better quality land.

Around 97% of land in PNG is still occupied and used under customary tenures similar to those that existed before colonialism. The PNG government has very little influence over this land and almost never deals with it, unless

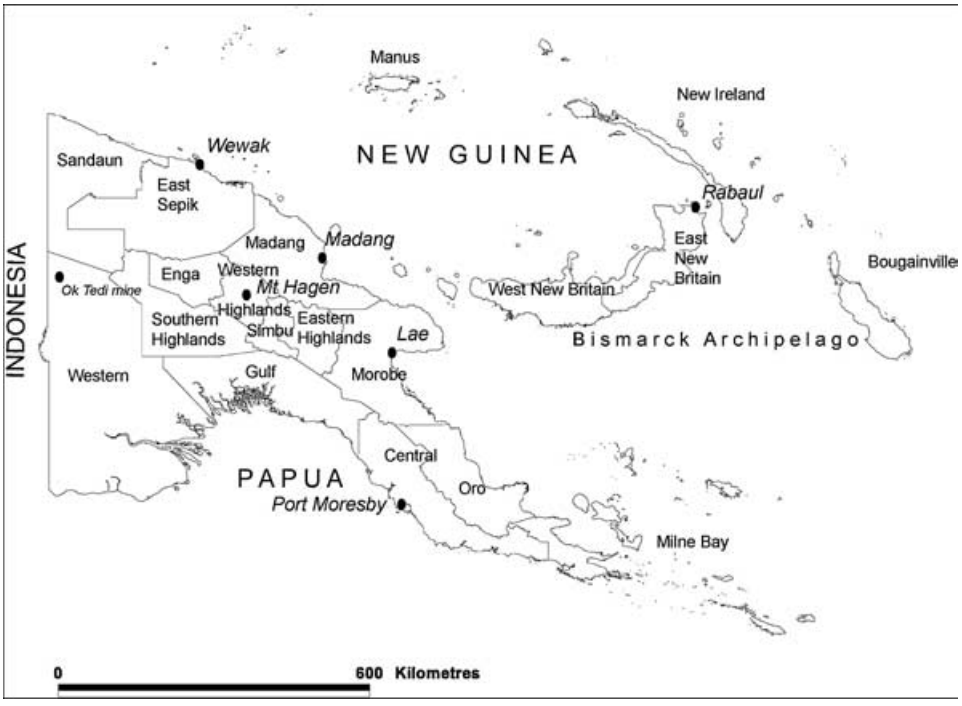

Figure 1. Papua New Guinea provinces and locations.

conflicts bring landowners into court, or disputes over land lead to violence. Groups, known as 'clans' administer access to land, mostly at the extended family level. Clans are usually small groups of closely related people who in principle trace their descent from a common ancestor. The vast majority of landowning groups ensure that land for subsistence production and cash cropping is available to all male heads of household who need it (Reay, 1959; Brookfield and Brown, 1963; Rimoldi *et al.*, 1966; Goldman, 1983; Fingleton, 1985).

Papua New Guinea societies are distinguished by a lack of inherited status. Two social anthropologists find, '. . . what differences there are between people of a social group are, with few exceptions, achieved through the exercise of personal qualities, rather than inherited. Moreover what power leaders wield is not different in kind from that wielded by men in general' (Gardner and Weiner, 1992: 123).

Pre-colonial PNG societies grew with their own labour the food that they consumed. However, as Brookfield argued in a number of papers (1972, 1984, 1986), much agricultural production had uses that went well beyond human nutrition. He argued that agricultural production in PNG could be classified into two or three types: production for the villager and his family, which he called *subsistence production*; production for ceremonial uses or gifting, called *social production*; and production for trade, which was indistinguishable from social production in many societies. He further proposed that social production was a greater driver of agricultural intensification and technological innovation than was population growth and that pre-colonial PNG agricultural systems were producing food in considerable surplus to what was needed for human sustenance.

Inequality in pre-colonial Papua New Guinea

The conditions that prevailed in pre-colonial PNG societies should have worked against the development of significant inequalities between groups of people. However, there is strong evidence that pre-colonial village economies were significantly different. The best evidence is that from Brookfield with Hart's (1971: 94–124) study of 'forty-four places compared', of which 26 were from PNG. They found marked differences in agricultural intensity and in the technologies employed to produce crops. Some of

these villages were considerably more productive than others, per area of land and per person.

Not only did some pre-colonial PNG groups produce greater surpluses than others, but they also had better diets. A wide range of dietary intake studies in PNG in the 1960s and 1970s examined diets that had changed little from pre-colonial times.[3] They found that diets ranged from 'adequate' to 'grossly inadequate' (for example, Korte (1976) who argued that PNG's population was poorly nourished). Macewan (1978), an agriculturalist, used data from the 1961/1962 Survey of Indigenous Agriculture (Walters, 1963) to investigate Korte's assertion. Macewan concluded that food supply should be adequate most of the time in most places. He concluded that poor nutritional outcomes could be caused by local problems of production, food nutrient quality, poor nutritional knowledge and sickness (of the producers).

Heywood and Nakikus investigated Macewan's suggestion that the nutrient quality of food was poor and found that diets based on PNG's starchy staples were often low in protein. They said, 'if the diet is deficient in protein quality and quantity, the protein requirement of the individual will not have been met by the time energy requirements are met' (Heywood and Nakikus, 1982: 331). They concluded that many diets fell below standard adequacy levels. They also observed that the 'total amount of food may be limiting, especially in some times of the year' (Heywood and Nakikus, 1982: 321). Drawing on results from the PNG National Nutritional Survey of 1982–1983, which was a *post*-colonial survey of the growth of children, to which we will return, Heywood and Norgan (1992) found that the outcome of inadequate diets was a significant difference in human growth across PNG. They referred to work by Malcolm (1969) who found a range of mean adult male stature in PNG of 148–166 cm, a greater range than reported for the whole of Asia.

Finally, in a review of the impact of cash cropping on nutritional status in PNG that compared pre-colonial conditions with post-colonial conditions, Heywood and Hide (1992: 214) concluded,

> Nutritional status prior to economic change appears to have been vulnerable. A major body of literature shows growth retardation, high infant mortality, late menarche, low adult stature, and low intake of energy and protein to be widely shared characteristics, especially in the highlands and highlands fringe zones.

The consequences of dietary inadequacies were reduced stature in adults and children. The consequences of low childhood growth rates have been shown to be higher mortality, retarded motor development and reduced work capacity. Smaller body size, 'whilst is it a response to adverse environmental conditions, is not biologically adaptive if it results in a sharp increase in mortality. Infant and child mortality mean that the resources invested in pregnancy and childcare are wasted' (Heywood and Norgan, 1992: 243).

So, despite good access to land and the absence of entrenched social hierarchies, some PNG societies enjoyed more adequate diets than others as a result of more productive agricultural systems. Furthermore, some agricultural systems produced significantly greater surpluses for investment in ritual and exchange than others. Societies that possessed these systems have been called 'successful' (Gardner and Weiner, 1992: 125) and 'powerful' (Forge, 1990). Their populations grew faster, their social organisations were more complex (Minnegal and Dwyer, 2001), their trade networks were more extensive and their leaders held sway over greater numbers of followers and larger local areas (Modjeska, 1982).

It is easier to say under what conditions these poorer pre-colonial groups lived, than *where* they lived. The pre-colonial data are patchy and there are no countrywide systematic studies of agriculture and food production until the 1961 sample survey of agriculture. The published information from the 1961 survey cannot be disaggregated into districts and the field survey data collection sheets appear to have been lost (R. Hide, pers. comm.). However, a number of researchers imply that environment is a major influence on the patterns of agriculture, diet and human growth that they observed and that human growth is related to survival rates in children and hence population growth. If it is assumed that groups in which diets were more adequate exhibited higher population growth rates than groups with inadequate diets, then a link between population and environment could

Table 1. Total land area, 2000 population and population density by land quality

Land quality	Land area (km^2)	Land quality class as % of total land area	2000 rural population	% of total rural population	Population density (persons per km^2)
Very low	85 270	18.5	468 300	10.9	5.5
Low	251 563	54.7	1 817 349	42.3	7.2
Moderate	92 121	20.0	1 151 418	26.8	12.5
High	20 532	4.5	511 264	11.9	22.0
Very high	10 368	2.3	348 003	8.1	39.4
Total	459 854	100.0	4 296 334	100.0	9.3

Source: Hanson *et al.* (2001); National Statistical Office of PNG (2002). PNG, Papua New Guinea.

provide at least an approximation of where the 'poorer' groups were located in pre-colonial PNG.

A positive association exists between population density, agricultural intensity (arguably a measure of agricultural 'success') and land quality (Allen, 2001; Hanson *et al.*, 2001). Average population densities on high and very high quality land are between four and six times those on poor quality land (Table 1). This marked spatial pattern of population distribution has not been greatly influenced by movements of people since the advent of colonialism and nor is it likely to be the outcome of pre-colonial migration.[4] Rather, it is attributable to long-term differential population growth under the conditions of better nutrition discussed above as well as a lower burden of diseases such as malaria, pneumonia and dysentery.

Having established that social and economic inequality existed in pre-colonial PNG and, with less certainty, having described, in broad terms, where the poorer groups were probably located, we will now show how colonialism and capitalism, under the influence of the same environmental forces, exacerbated this pattern of inequality in rural PNG.

Development of rural poverty in Papua New Guinea

At a gross countrywide level of analysis, and even though the character of pre-colonial inequality was different from contemporary rural poverty, the spatial distribution of pre-colonial inequality was probably not that different from that of contemporary rural poverty. This contradicts a body of literature on underdevelopment and the development of poverty that argues that underdevelopment is created by the 'asymmetry of power' that is inherent in 'market relations' (Perroux, 1950) and the way in which such inequalities increase cumulatively in a circular fashion (Myrdal, 1970). We argue that in PNG, when market forces first appeared in the late 1800s, represented by the colonial capitalist enterprises of plantation agriculture they were influenced by, or in Brookfield and Hart's (1971: 309) words, were 'sensitive' to, the same environmental conditions that brought about the differences observed for pre-colonial PNG agriculture.

The plantation owners sought land that was relatively flat, not seasonally flooded, with good soils, easy access to international markets and a good supply of labour.[5] Colonial administrators sought to administer the greatest number of people at the lowest cost and focused their efforts at building infrastructure (including patrol posts, schools, aid posts, airfields and roads) where there were the greatest concentrations of people. The Christian missions followed a similar strategy. The greatest numbers of people were living on the best quality land, the same land that attracted the colonial planters. Colonial miners on the other hand, were forced to locate their enterprises at the site of the resource, which were often in isolated and relatively poor areas. They established significant enclave developments by constructing airfields at their mines and using aircraft to transport machinery and labour to an extent not seen anywhere else in the world at that time (Sinclair, 1978).

We are not alone in arguing that the way in which the institutions of colonialism responded to differing environmental constraints influenced subsequent patterns of development. Acemoglu *et al.* (2001) find that different colonising strategies adopted by European

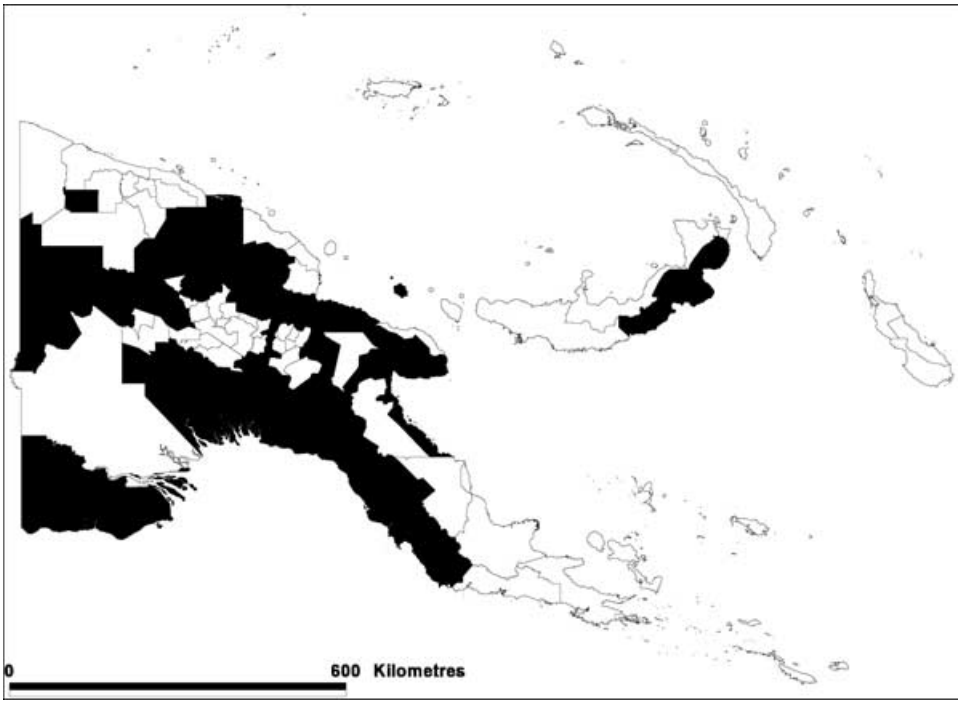

Figure 2. Poor areas in Papua New Guinea, pre-1880 to 2000. Districts in which the majority of land is 'very poor' or 'poor' potential for the production of sweet potato (the measure of land potential is based on rainfall, seasonality, temperature, sunshine, inundation, slope and soils) (*Source:* Hanson *et al.*, 2001: 23).

countries in the nineteenth century were influenced by the 'feasibility' of European settlement. Where settlement was constrained by poor environments (in their cases latitude, climate, diseases, natural resources and soil quality), a strategy of extracting resources to the metropole as quickly as possible was followed, whereas where settlement was attractive, investment and economic growth took place.

The map of land potential, especially 'very poor' and 'poor' potential land provides insights into why the colonial development pattern took the form it did (Figure 2). Much of the poorer quality land in PNG is located at the western end of the central highlands. It extends east along both sides of the highlands, along the mountains of the Huon Peninsula to the north-east, and south-east along the Owen Stanley mountains into Milne Bay, in the south of Western Province, in coastal Central Province, and along the south coast of New Britain.[6] Commercial and administrative development took the inverse of this pattern, favouring the Gazelle Peninsula in East New Britain, Bougainville and New Ireland and the highlands and valleys. What happened in the highlands and valleys immediately after the 1942–1945 war in the early 1950s is a good illustration of the processes involved.

The people of the highlands valleys remained 'undiscovered' until the 1920s, when explorer–gold miners penetrated the mountain passes and stumbled upon large populations and intensive agricultural systems, on high quality land. The 1942–1945 war resulted in a number of airstrips and patrol posts being established in the highlands. Almost immediately after the war, the establishment of commercial coffee plantations, the construction of additional administration posts and airfields and the opening of Christian missions occurred quickly and simultaneously. The expatriate owned commercial sector lobbied strongly and successfully for road access to the coast at Lae to reduce the costs of transport by air. The administration constructed a road (now the most important road in PNG) from Lae into the highlands, connecting plantations, administration posts and missions, to the global economy. In contrast, a road that would have linked Port Moresby, the colonial capital, to Lae and the highlands, but which would have

traversed poor quality land that is still the location of significant poverty, was never constructed. Economic rates of return on a transnational highway compared to the Highlands Highway were extremely low or negative (Crotty, 1972) and remain so today. As a result, development spread along the highlands valleys from east to west, but did not spread north and south into the mountainous highlands fringes. Today these areas, characterised as a 'population sink' in pre-colonial times,[7] remain poor and isolated.

Throughout PNG, villagers were assisted by both the colonial government and the planters, to participate in the global economy as smallholder cash croppers. At first, they sold surplus coconuts from village plantings, and then planted village plots of coconuts and cocoa in the lowlands and coffee in the highlands.[8] The colonial administration and missions encouraged village smallholders, in some cases by making it compulsory to plant a minimum number of producing trees, or through the establishment of cooperatives and by creating agricultural extension services and providing improved tree seedlings. Tens of thousands of villagers, with good access to land on which to plant relatively small numbers of cocoa or coffee trees, enthusiastically adopted cash cropping.[9] Many had spent at least one contract working as plantation labour where they had glimpsed the world of commercial agriculture and learned the agronomic requirements of the new crops. Their village enterprises were advantaged by the roads, ports and marketing facilities that had been developed for the commercial sector.

This caused rapid 'economic differentiation' to occur in village PNG. It favoured those areas where cash cropping was able to be established and left behind those areas where it was not possible. The favoured areas were those that had been relatively more productive prior to colonial intervention. Over 30 years ago, using 1967–1968 data, Brookfield and Hart (1971: 296) recognised the primary causes of this pattern of development.

> The limited area occupied by export-crop production; the similarity in the distribution of Expatriate-controlled and Melanesian-controlled production; the virtual exclusion of wide areas, especially in the west, from any significant participation in the production of exports, except through migrant labour. There is very little cash-production indeed west of the longitude of Mt Hagen, yet almost half of the total area of the country lies west of this line. The heavy concentrations in parts of the Bismarck archipelago, and the secondary concentrations in the central highlands, and in some coastal and island areas of the eastern peninsula, emerge very clearly.

Brookfield and Hart (1971) did not refer to Myrdal's work. However, their description of the establishment of the smallholder cash sector in PNG is recognisable as a form 'cumulative causation'. The 'spread effects' could not overcome the severe environmental constraints to the establishment of cash cropping in poorer areas, whereas the 'backwash' drew labour and scarce public funds into the better-off areas.[10]

> Much else goes with these contrasts in incomes, for the higher spending power of wealthier districts tends to command a higher level of services, not only from the commercial systems, but also from Government. Local council taxation levels vary with capacity to pay, but the ability of councils to contribute to the costs of schools and medical aid-post construction has an effect on the level of education and health services provided. Thus the rich get richer. (Brookfield and Hart, 1971: 302).

Brookfield and Hart were 'startled' by the almost ten-times of difference between per person incomes being received for cash crops in the islands provinces of East New Britain and New Ireland and the emerging highlands coffee-growing provinces typified by Eastern Highlands, compared with the 'almost pitiful incomes of the four westernmost (provinces) – East Sepik and West Sepik, Southern Highlands and Western' (Brookfield and Hart, 1971: 301) (Figure 3).

In 1966, the pattern of income disparity was observable only at the province level, because of a lack of district data, which makes comparison with the district-level patterns used in more recent research difficult. Nevertheless, it is possible to see in broad terms, a pattern of poor areas that, with one or two notable exceptions brought by enclave mining developments, has been maintained to the present day.

Another observer of these patterns was Wilson (1975), who used 1969–1970 data and applied

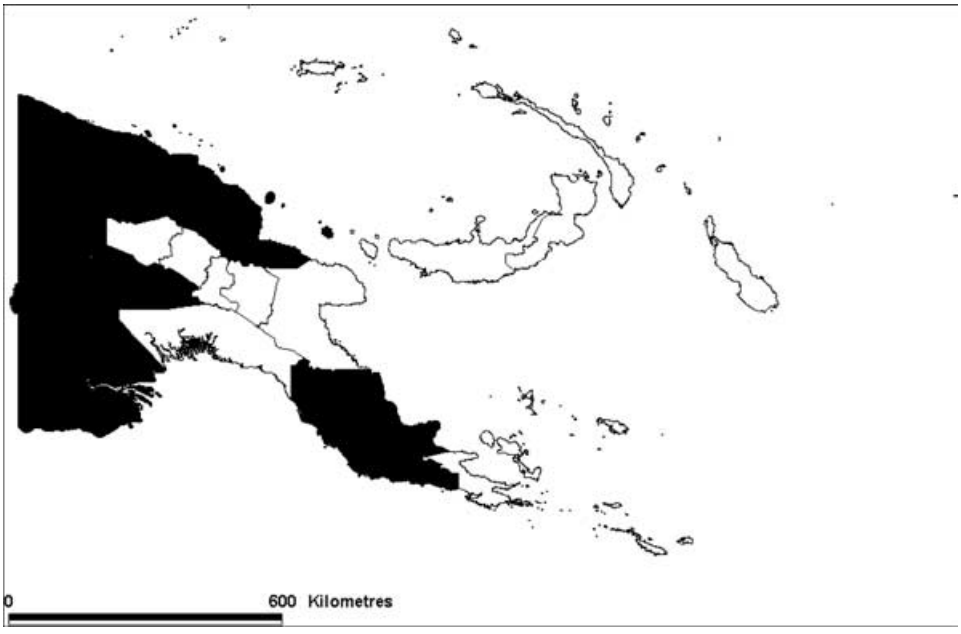

Figure 3. Poor areas in Papua New Guinea, pre-1880 to 2000. Provinces earning less than four Australian dollars per person from cash cropping in 1966 (9 out of 18) (*Source:* Brookfield and Hart, 1971: 300).

six 'socio-economic indicators' to investigate differences in socio-economic development between different areas in Papua New Guinea. Wilson compared the then 79 subdistricts[12] on village cash-crop production, hospital and health centre beds, administration staff, school enrolments, access to services and the grade of local government councils. Most of the districts that fell into Wilson's most developed Group 1 had a major urban centre within them. The rest of the districts that fell into Groups 1 and 2 either were in the Islands Region, or were close to the Highlands Highway in Morobe and the highlands provinces east of Mount Hagen. Wilson attributed the reasons why districts fell into his least developed Groups 5 and 6 (mapped in Figure 4) to 'isolation' and 'poor environments' (Wilson, 1975: 84).

A decade later, de Albuquerque and D'Sa (1986) used data from 1979 to 1980 to examine 'spatial inequality' in PNG. They hypothesised that the 'best intentioned policies for redistribution and promoting basic needs' had not been able to overcome the forces of the 'historical patterns of colonialism' and colonial development policies, the 'unequal distribution of natural resources' and the problems of 'accessibility' (de Albuquerque and D'Sa, 1986: 1). de Albuquerque and D'Sa derived a set of indicators of development with which to group districts and to compare these findings with previous studies, in particular Wilson's. Their main findings were that levels of education, low child-dependency ratios, urbanisation, good access to services and the proportion of the population living in rural non-village[12] settings were positively associated with socio-economic development. Figure 5 shows the distribution of the least developed of de Albuquerque and D'Sa's six 'factor score index' groups, mapped into 2000 districts.[13] Their 'most developed' districts were located in the Islands Region on New Britain, Bougainville and New Ireland provinces. The next-ranked districts were those surrounding national and provincial centres of Port Moresby, Lae, Alotau, Mount Hagen, Wewak, Lorengau and Kerema, a spatial pattern that can be seen emerging in Wilson's most developed Group 1 districts. Least-developed districts were located in the central western end of the country across the main mountain range from the Indonesian border east to the highlands valleys, where they split, to run down both sides of the highlands, and join again in the Owen Stanley mountains. In the islands, the south coast of New Britain was relatively undeveloped.

Most recently, Hanson *et al.* (2001) ranked the 85 rural districts of PNG on an index of

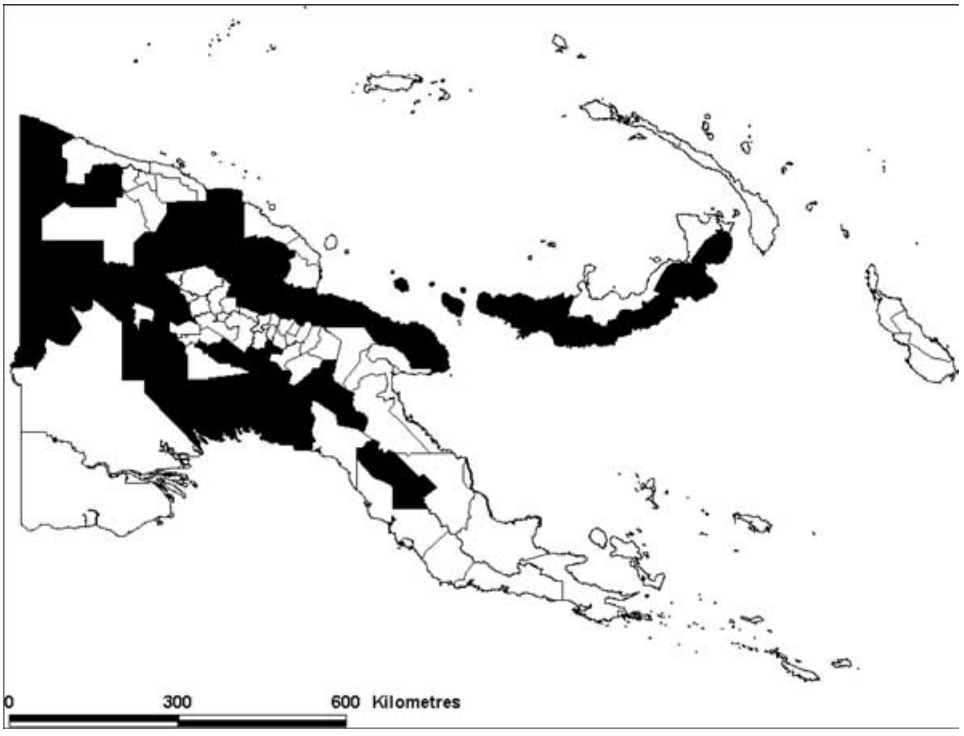

Figure 4. Poor areas in Papua New Guinea, pre-1880 to 2000. Least developed districts (Groups 6 and 7, 26 districts out of 79) 1970 (*Source:* Wilson, 1975).

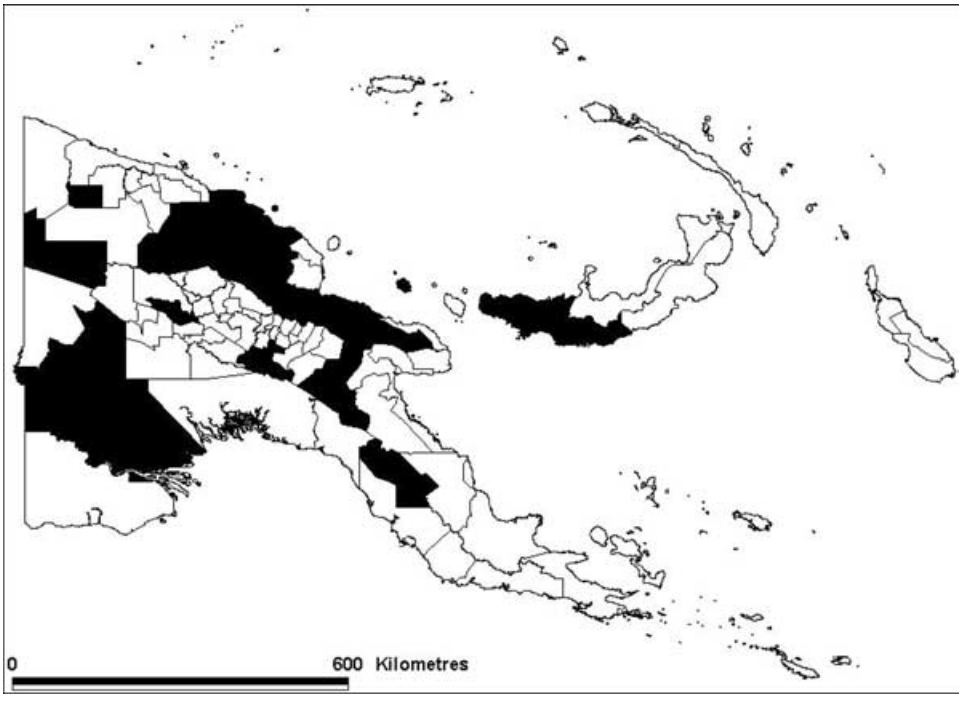

Figure 5. Poor areas in Papua New Guinea, pre-1880 to 2000. Least developed districts (Cluster 7 only, 18 districts out of 87), 1980 (*Source:* de Albuquerque and D'Sa, 1986).

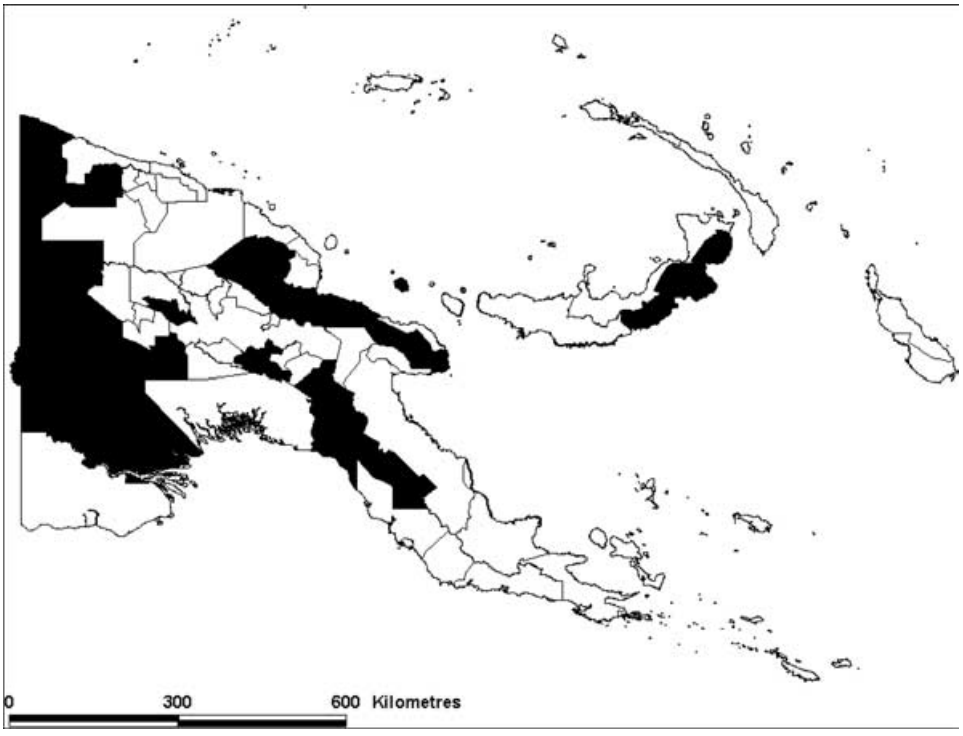

Figure 6. Poor areas in Papua New Guinea, pre-1880 to 2000. Most disadvantaged districts (36 districts out of 85, ranked on land potential, agricultural pressure, access to services, income from agriculture and child malnutrition), 1996 (*Source:* Hanson *et al.*, 2001: 305).

'disadvantage' using five variables: land potential (as a measure of future development potential, using data from PNGRIS), estimated cash income from agriculture (from MASP), agricultural pressure (measured by population density against land quality), access to services (the estimated number of hours taken to reach the nearest service centre by surface transport), and child malnutrition (the relative position on a weight-for-height by height-for-age table from the results of the 1982–1983 National Nutrition Survey redistributed into the 2000 districts).[14] The spatial pattern of the most 'disadvantaged' districts is by now familiar (Figure 6): they are located along the Indonesian border in the west, to the north and south of the highlands, along the Huon Peninsula and the Owen Stanley mountains on the mainland and along the south coast of New Britain.

Rural poverty in contemporary Papua New Guinea

Poverty analysts have recently developed techniques for combining the detailed information from household sample surveys with the more extensive coverage of a census. Data are collected from sample households to estimate a model of consumption, with the explanatory variables restricted to those that are also available from a recent census. The coefficients from this model are then combined with the variables from the census, and consumption and the risk of poverty are predicted for each household in the census. Weighted totals of the predicted poverty probabilities can then be estimated for small geographic areas. Hentschel *et al.* (2000) and Elbers *et al.* (2003) show that the incidence of poverty calculated from a census, based on the imputed consumption figure, is close to that calculated from survey data but with a much greater level of statistical precision.

These techniques were used to create disaggregated maps of poverty in rural PNG (Gibson *et al.*, 2005). Information from the 1996 household survey was combined with data from the 2000 census, and resource and agricultural mapping databases with national coverage.[15] The PNG 1996 household survey was a sample survey of consumption and a number of

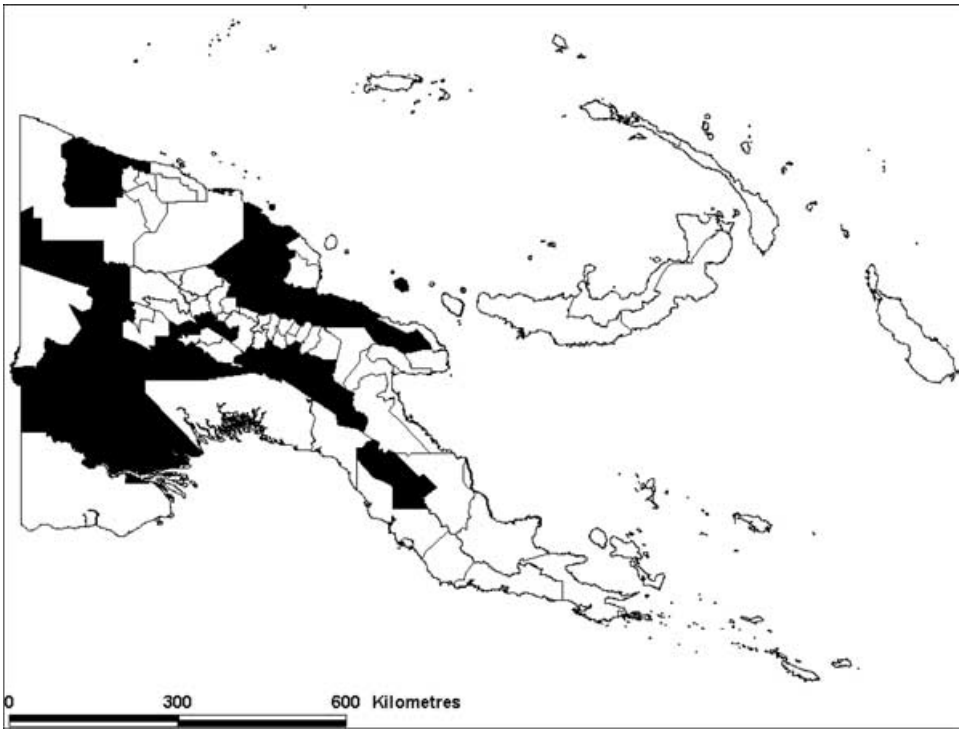

Figure 7. Poor areas in Papua New Guinea, pre-1880 to 2000. Highest 25% of districts by predicted poverty rate (21 districts out of 85) 1996 (*Source:* Gibson and Rozelle, 2003).

poverty lines were established on the basis of the survey.

The pattern of poverty predicted by this analysis, aggregated to the level of the district,[16] is shown in Figure 7. Places in which the predicted poverty rate is high occur right across the western end of the country, in Sandaun Province (West Sepik) in the north and Western Province in the south. Only the Ok Tedi mine in the north-west of Western Province disrupts this pattern. Other districts that are predicted to have a high poverty rate are located along the northern and southern fringes of the highlands (the highlands valleys are noticeably predicted low poverty areas), along the Huon Peninsula and down the central mountainous spine of the mainland into Central Province. Low levels of poverty are predicted for the Islands Region, although the southern side of West New Britain falls into same district as the northern side and the high-income oil palm resettlement schemes on the north coast hide the relative poorness of the south coast.

The sequence of maps in Figures 2–7 shows a pattern that had taken on its basic form by 1966 and has remained consistent for over 40 years. The map of land potential that begins the series probably reflects the pattern of 'poor' places that was in existence in PNG prior to the advent of colonialism and capitalism. The patterns displayed in this map are not similar to the pattern of contemporary poverty revealed by the poverty survey or the 2001 maps of 'disadvantage'.

This is so because severe environmental constraints exist in PNG that have restricted development, in both the broadest sense of that term and in the restricted sense of village-based cash cropping, to areas with fewer environmental constraints. Over time, both economic and political forces have tended to favour the better-off places, despite development policies that have attempted to reduce this differentiation. The World Bank funded Southern Highlands Rural Development Project in the 1980s is a good example. This project established blocks of coffee and tea in the undeveloped western part of the province but none have survived to the present day. Land quality was poor, altitudes marginal or rainfall very high. Although the blocks were sited on vehicle roads, they were

still more than 600 km from Lae and 200 km from Mount Hagen and transport costs drove prices below the point that villagers found acceptable. Adoption of the crops by individuals was very low.

Consequences of being poor in Papua New Guinea

It is common in both PNG and Australia to hear an opinion expressed that being poor in the PNG subsistence sector is not a real disadvantage because land is plentiful and everyone who is prepared to work can produce food, build their own houses and live in bucolic bliss. Unfortunately, this perception is not reflected in reality.

If PNG districts are ranked by predicted poverty rate and the upper and lower quartiles are compared, statistically significant differences exist on indices of child growth, adult literacy and school enrolment[17] (Table 2). In the case of child growth, it has been shown, at least for highlands children, that high levels of stunting are positively associated with an increasing probability of dying in children under five years of age (Heywood, 1982). So poverty in rural PNG is not just a matter of doing without some of the luxuries of modern life. It can be a matter of life and death.[18]

Nor in rural PNG is the ability to consume imported food a luxury. We have already observed that, for reasons of dietary imbalance and overall supply, pre-colonial PNG diets were characterised by nutritionists as 'vulnerable'. Papua New Guineans who earn cash from the sale of export cash crops, betel nut, fresh food, firewood and tobacco, use this cash to purchase imported rice, flour, fish, meat, animal fats and vegetable oils and so supplement their 'vulnerable' subsistence diets (Bourke, 2001). Imported food is also purchased during short-term disruptions to subsistence food supply. Increases in imports of rice and flour, in particular, coincide with food shortages, like those that affected parts of the country in 1982 and 1984, or the whole country as in the 1997–1998 El Niño Southern Oscillation (ENSO) event.[19] The most striking pattern to emerge from the 1997–1998 drought event was not the physical impacts of the drought, but the inability of people in poor and isolated places to compensate for the loss of food with purchases of imported food, compared to their better-off country persons. The food relief programme undertaken by the Australian Defence Force and the Australian Agency for International Development (AusAID) was restricted to places with no road access (Allen and Bourke, 2001).

The regular consumption of small amounts of imported food has been shown to be associated with increased growth rates in children and greater adult stature (Harvey and Heywood, 1983). However, because cash cropping has been closely associated with improvements in education and health services and roads, it is not easy to disentangle the benefits of increased cash incomes from the associated improvements in services and accessibility, to demonstrate the singular benefits of improved diets (Heywood and Hide, 1992: 213–214; Gibson, 1999).

The converse of this pattern occurs where people either cannot grow crops for sale, or cannot get them to market. High altitude, cloud cover, high rainfall, inundation and steep slopes

Table 2. PNG Districts 2000: Proportion of the population classified as 'poor', adult literacy rates and gross school enrolment rates by upper and lower quartile of predicted poverty

Measure	Highest quartile, predicted poverty		Lowest quartile, predicted poverty	
	Median (%)	Mean (%)	Median (%)	Mean (%)
Proportion of population'poor'	52	54	26	25
Proportion of children <5 years of age, <80% weight-for-age	56	–	34	–
Adult literacy rate	40	43	55	59
Gross school enrolment rate	30	32	45	46

Source: National Economic Fiscal Commission of PNG (2004); Craig Sugden, Focus Economics, Brisbane. PNG National Nutrition Survey 1982–1983 re-estimated for 2000 districts by I. Muller, PNG Institute of Medical Research. PNG, Papua New Guinea.

limit the production of cash crops. These environmental constraints commonly go together with poor access due to lack of roads, so that transporting crops to a market is very difficult or expensive. The 1996 household sample survey demonstrated that this situation results in poorer diets. If consumption is regressed against travel time to the nearest transport facility, a one-hour increase in travel time is associated with a reduction in consumption of almost 10% (Gibson and Rozelle, 2003).

Conclusion

This paper has explored an argument made by Brookfield and Hart using 1966 data, that development in PNG was closely associated with the production of export cash crops and as a result was heavily influenced by the quality of the environment. It has argued that the pattern of poverty revealed by a 1996 World Bank poverty survey was evident in patterns of inequality that existed even before the advent of colonialism or capitalism. Behind the pattern of poor areas are a number of severe environmental constraints: very high altitude, high rainfall, steep slopes, flooding and poor soils. These constraints influenced the initial pattern of the establishment of a plantation economy in PNG, which in turn influenced the establishment of smallholder cash cropping for export and in addition, access to domestic markets for the sale of fresh food and betel nut. The poor places in PNG are most often places that cannot participate in this engagement with the market, rather than, as some development theories predict, places that became involved in unequal market relationships.

The long-established pattern of inequality, traceable to a period in PNG history when there was no market and no state, strongly suggests that *in situ* PNG poverty will be very difficult to eradicate. The environmental constraints remain in place and cannot be easily overcome. Thus, Brookfield and Hart's 'dilemma' remains as 'acute' now as it was in 1970. However, now we have more evidence about what the outcomes are likely to be, if one choice is made over the other. A number of state-sponsored attempts to attack PNG poverty have not been successful. A Less Developed Areas Policy in the 1970s, the Eight-Point Plan of the first independent government of PNG and the National Public Expenditure Plan of the 1980s, all designed to equalise development, failed to significantly move resources from better-off areas to poorer areas. A number of large rural development projects funded by the World Bank and the Asian Development Bank in the poor areas identified by the work of Wilson and de Albuquerque and D'Sa have not significantly modified the patterns of poverty presented in this paper.

Government manages budgets poorly and fails to set targets for spending in poor rural areas. Strong political demands from the provinces to maintain a decentralised system of administration continue to plague the implementation of health and education programmes. Poor places have a tendency to be located along the boundaries of administrative units, so that no administration takes responsibility for them. Isolation renders others 'invisible' from national and provincial headquarters.[20] Baxter (2001: 77) sets out a number of sensible recommendations but they require reasonably radical reforms of government and administration if they are to be implemented.

The solution would seem to be simple: build more roads, schools and health centres in poor areas. But road construction is not a practical solution to the reduction of poverty in PNG at present. First, the majority of rural people in PNG already have access to a road, a result of a vigorous colonial road building programme in which rural people built thousand of kilometres of roads by hand. Many of these roads have fallen into disrepair and are now impassable when wet. Second, the places that do not already have access to a road are located where mountainous terrain or seasonal flooding makes building a road technologically challenging and maintaining it very expensive. Third, PNG does not maintain the roads it has now, which is why much of the rural road network that was in existence in 1975 is now impassable. Over the last few years, the PNG government has spent on road maintenance only 40% of the amount required to adequately maintain the national highways, without taking into account many important rural feeder roads.

Importantly, however, while we ponder this dilemma, poor people are not sitting in their isolated and poor places waiting for help to come to them. They are moving to better-off rural places. The sharply increased cost of urban living that

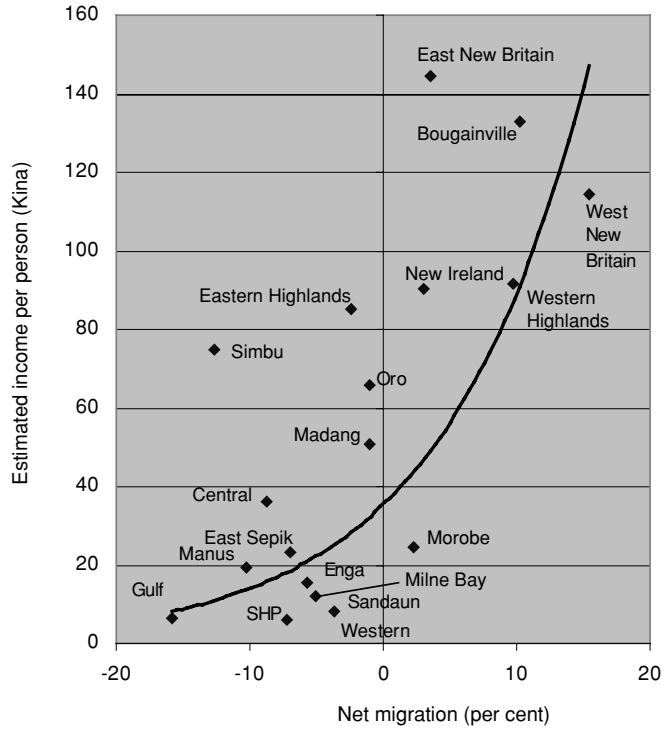

Figure 8. Net migration by average estimated income per person, Papua New Guinea provinces 2002. (*Source:* National Statistical Office of PNG (2002); Mapping Agricultural Systems Project.)

resulted from the steep decline in the value of the kina in 1998[21] is leading to increasing rural-to-rural and rural-to-peri-urban population movement and in a probable reduction in rural-to-urban migration. Half of the provincial net migration that is identifiable in the 2000 census can be explained by the average estimated income per person (Figure 8).[22]

People are moving from poor environments to rural locations near roads, with access to markets and education and health services. In 2000 around 100 000 households, or 10% of all households, were resident in a province other than that in which the head of the household was born. Ultimately, the only practical solution open to the people who occupy PNG's poor places may be to move away from them. It remains to be seen whether poor households that migrate become less poor, but Ravallion and Woden (1999) argue that place is a greater determinant of poverty than either household or family attributes.

Notes

1 In a study on the benefits of rural roads in Nepal, Jacoby (2000) claims he has chosen an interesting place to work because of the extreme need for roads. The mean travel time in Nepal between the average household and the nearest marketing centre is 2.8 hours. Arguably, however, PNG's rural communities are even more isolated. The average travel time to the nearest government station (which is the closest thing in PNG to a Nepali market town) is more than 3 hours. The average travel time to the nearest road is 2.5 hours.

2 Land quality was determined by estimating the capability of land to grow sweet potato, the crop eaten as a staple food by over 60% of the population. The method is based on information on inundation, slope, and soil type from the PNG Resource Information System (PNGRIS) (Bellamy, 1986); modifications to land (such as drainage and composting) from the mapping agricultural systems in PNG (MASP) database (Bourke *et al*., 1998); annual rainfall from the Centre for Resource and Environmental Science, The Australian National University (Faith *et al*., 2001); cloud cover from Advanced Very High Resolution Radiometer (AVHRR) satellite imagery analysed by CSIRO (McVicar and Bierwirth, 2001) and expert knowledge.

3 This section draws on more detailed material presented in Hide *et al.* (1992). Dennett and Connell (1988) provide another review of this literature.

4 Brookfield and Hart (1971: 77) rejected their own hypothesis that the relationship between population distribution and population density meant that 'all local systems, wherever located, are in interdependent relationships with all others'.

5 See Brookfield and Hart (1971: 248) for a discussion of how a wide scatter of coconut plantations on isolated small patches of good land along the coast were abandoned once shipping costs were no longer subsidised by colonial governments.

6 See footnote 2. This method of defining land potential probably overemphasises high altitude as a limitation on crops. The relatively large areas of good quality land in Sandaun Province are probably the outcome of an error in photo interpretation by CSIRO (John McAlpine, pers. comm., 2001).

7 An area where groups pushed out of the highlands valleys could not sustain their numbers, because of high rates of disease and poor living conditions (Stanhope, 1970).

8 Brookfield and Hart (1971: chapter 11) describe the relationships that developed between what they term the 'commercial' and the 'peasant' systems in Melanesia.

9 Enthusiasm to plant coffee in the highlands was such that when colonial PNG exceeded quotas given to it under an International Coffee Agreement in the mid-1960s, coffee extension officers were ordered to stop smallholders extending plantings. They were unsuccessful. The recent rapid spread of vanilla cultivation over the last 6 years is another illustration of how PNG villagers will respond quickly to agricultural activities that offer high cash returns, even in the absence of formal extension work.

10 Myrdal (1970: 280) states a 'growing point' established by the location of a factory or any other expansional move will draw to itself other businesses, skilled labour and capital. It will by the same token have backwash effects that keep down or even impoverish out-regions.

11 Since 1972, 'districts' have become provinces, 'sub-districts' have become districts, the boundaries of the then districts and the number of districts has changed.

12 Rural non-village (RNV) was a census classification that included small administration posts, schools, plantations, missions and resettlement schemes.

13 Since 1980, the boundaries of some of the then districts have been changed. We have adjusted the 2000 districts to 'best fit' the 1980 district. However, the match is not perfect.

14 The 1982–1983 National Nutrition Survey (NNS) results were redistributed into the 2000 districts by Dr Ivo Muller, PNG Institute of Medical research. The data used by Wilson (1975) and de Albuquerque and D'Sa (1986) are no longer available for all districts in the country. The advent of provincial government resulted in a severe breakdown of data collection of key development indicators at a national level.

15 The focus is on rural poverty because in 1996 almost 95% of the poor were located in the rural sector (World Bank, 1999). The resource and agricultural mapping databases are less relevant for modelling urban poverty.

16 The lowest level to which it is possible to aggregate these data is the Local Level Government Area (LLGA). Because the other comparative analyses used in this paper are at the district level we do not go below the district. Also, less radical changes have occurred in the district as a spatial unit, than in the LLGA, which is a new unit in the 2000 National Census, based broadly on, but not exactly the same as, the Census District, which was not used in 2000, but has been used in all previous PNG censuses.

17 The district data on adult literacy, education and health was assembled by the PNG Department of National Planning and Monitoring and the National Economic Fiscal Commission with assistance from Craig Sugden, Focus Economics, Brisbane. Kruskal-Wallis tests show all measures to be significantly different at the 0.001 level of confidence.

18 An illustration of life in a rural area with low potential land, low cash incomes and poor access to services and markets is contained in Allen *et al.* (1980).

19 In 1997–1998 an additional 58 000 tonnes of rice over previous years was imported into PNG. Seventy-five per cent of this rice was purchased through retail outlets. Only 25% was distributed as food aid (Whitecross and Franklin, 2001; Allen and Bourke, 2001: 160).

20 There is evidence that not only are poor places 'invisible', but they are 'disappearing'. A number of groups in the isolated Hewa area of the Southern Highlands Province that were censused in 1980 and 1990 were not censused in 2000 and their census units are no longer included on the national listing. This is the ultimate expression of 'out of sight, out of mind'. See also World Bank (1999).

21 The kina declined in value from $US 0.76 in 1996 to below $US 0.20 in 1998.

22 If estimated per person income is regressed against per cent net migration the line of best fit is described by the following equation, $y = 0.0912 \times 2 + 4.0732x + 55.359$. $R^2 = 0.52$. Net migration is estimated by the number of resident heads of households in a province who were born in another province minus the number of migrant heads of households who were born in the province as a percentage of total heads of household.

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