Tinned fish and rice are unloaded from a small aircraft at Ogeranang. There are many remote communities living in the mountainous regions of Morobe Province where road access is limited. In such circumstances, aircraft are the only form of transport for basic household goods, cash crops and people, particularly the elderly and the sick. The high cost of transport keeps prices in trade stores high and returns on cash crops low. It also restricts people’s ability to access information and exert political influence in the urban centres.

Steep grassland terrain in the Leron Valley. A long dry season and frequent burning have created large areas of grassland in the province, particularly in the Markham, Watut and Snake valleys. The steep grassland terrain is often unoccupied, while the fans and plains are used by people for low to moderate intensity banana cultivation. These dry seasonal environments are well suited to certain cash crops such as mango. There is a large unsatisfied demand in both the highlands and urban locations for good quality mangoes and other sweet fruit.

Morobe Province
Morobe occupies 33,525 km² in the central north of PNG. It extends from the Owen Stanley Range northeast across two major fault valleys to the coastal ranges and offshore islands. The northwest is dominated by the Sarawaget Range, while the northeast includes the mountains, valleys and coastal plains of the Huon Peninsula and Umbri Island. The Markham Valley runs through the middle of the province from the Madang border, in the west, to the Huon Gulf south of Lae. The Wairat Valley runs from the southwest to the Markham Valley and is joined by the Snake and Bulolo valleys. The southwest includes the Menyamya area and the Elouri Range. The southeast of the province includes the Garaina area in the Waria Valley, rugged coastal ranges, and the narrow coastal plains and islands extending from the border with Oro Province to Salamanca. Note that these coastal plains are referred to here as the Morobe Coast. Altitude varies from sea level to over 4000 m on the Sarawaget Range. The highest gardens in the province are found near Tefep at an altitude of 2600 metres. Average annual rainfall varies from 1600 mm in the Snake Valley, to over 4000 mm around Lae. Most of the province has a long dry season. The nine districts in Morobe are Bulolo, Finschhafen, Huon Gulf, Kabwum, Lae, Markham, Menyamya, Nawae and Tewai-Siassi. Lae District is mostly urban and is not described here.
The estimated rural population of Morobe in the year 2000 is 307,000, which is 7.6 per cent of the national rural population. The average provincial rural population growth rate is 1.5 per cent per annum. Population densities are highest on Malai and Tiam islands, near Umboi Island, with 400 persons/km². The Sialum coastal plains, the south coast of Umboi Island and the Kabwum area have densities of 105 persons/km². Areas around Tepetep, Wau and the upper Snake Valley have high densities that average 70 persons/km². The remainder of the province has low to moderate population densities. The peri-urban areas around Lae and the upper Watut Valley near Wau have significant in-migration of people seeking better access to services, more productive environments and wage employment. The Menyamya area, the southeastern end of the Huon Peninsula and the area inland of Salamaua have significant out-migration.
Despite its large size and mountainous terrain, there is a good road network in Morobe Province and access to services is generally good. The Highlands Highway runs from Lae to the Madang and Eastern Highlands borders through the Markham Valley. An excellent sealed road runs from Lae to Wau, while a gravel road connects Bulolo to Menyamya and Aseki. There are roads from Wau to Kabwum and from Finschhafen to Sialum and Pindiu, although they do not connect to Lae. Small boat transport is common in all coastal areas, while Umboi Island is reached through passenger shipping services. Sea travel is dangerous between December and March. The majority of people in the province are within four hours' travel of the nearest service centre. The least accessible areas in the province are in the northwest of the Sarawaget Range, from Menyamya north to the Markham Valley, and in the Waria Valley around Garaina.
Morobe has diverse sources of rural cash income. Highest incomes occur close to the major roads. People in the Markham and Watut valleys have very high incomes from the sale of betel nut and fresh food. Those living in the upper Watut Valley have moderate incomes from the sale of coffee, betel nut and fresh food, while those on the coast either side of Lae have moderate incomes from the sale of cocoa, coconut, fish, betel nut and fresh food. People in the Kabwum area have moderate incomes from the sale of coffee and fresh food. Those in the remainder of the province have very low incomes. Mining near Wau, forestry near Bulolo and cattle ranches in the Markham Valley provide some wage employment and royalties. A tea plantation was in operation near Garaina, but is now disused. The demand for labour and food in the urban areas of Lae is an important influence in the province and beyond.

**Income**

<table>
<thead>
<tr>
<th>Income Level</th>
<th>Description</th>
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<tbody>
<tr>
<td>Very low</td>
<td>0–20 kina/person/year</td>
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<tr>
<td>Low</td>
<td>21–40 kina/person/year</td>
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<tr>
<td>Moderate</td>
<td>41–100 kina/person/year</td>
</tr>
<tr>
<td>High</td>
<td>101–200 kina/person/year</td>
</tr>
<tr>
<td>Very high</td>
<td>&gt; 200 kina/person/year</td>
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</tbody>
</table>

**Unoccupied land**

<table>
<thead>
<tr>
<th>District Boundaries</th>
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<td>District boundaries</td>
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Inset 1
Agriculture in the Markham and Watut valleys is dominated by moderate intensity banana cultivation, supplemented by sweet potato in the Watut Valley. On the Sarawaget Range and Huon Peninsula, Chinese taro and sweet potato are grown in low to moderate intensity gardens. People in the Menyamya area, in the Waria Valley, on the Morobe and Bukaua Coasts and in the higher altitude areas of the Huon Peninsula, plant low intensity sweet potato gardens with other minor staples. In the Tepep area, people cultivate moderate intensity sweet potato gardens and employ composting and mounding as land management practices. This is the only place outside of the highlands where people practice composting.
There is little high potential land in Morobe Province. Most land has very low to moderate potential. Few land improvement practices are used. The largest area of very high potential land occurs in the upper Waria Valley and on the east coast of Umboi Island. Small areas of high potential land also occur near Lae, Kaisipir, Garaina and on the west coast of Umboi Island. Most of the inhabited coastal areas have moderate potential due to a long dry season and shallow soils. The Menyamya area, Sarawaget Range and Huon Peninsula have very low to moderate potential land due to steep slopes, poor soils, frequent cloud cover and low temperatures at higher altitudes. The inhabited areas of the Markham and Warut valleys have low to moderate land potential caused by poor soils, a long dry season and frequent inundation in floodplain areas.

### Land potential

- **Very high potential**
- **High potential**
- **Moderate potential**
- **Low potential**
- **Very low potential**
- **Unoccupied land**

#### Map of Morobe Province

- **Inset 1:**
  - Number of people
  - Kilometres
  - District boundaries

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Papua New Guinea Rural Development Handbook — Morobe Province
There is strong agricultural pressure on land around Tepet and Wantoat, and on Malai and Tuam islands, caused by moderate to high intensity agriculture being practised in poor environments. There is moderate pressure in the Markham, Urawa, Erap and Wanut valleys, and also in smaller areas around Yasuru, Imaine, Wasu and Finschhafen, Much of umbui Island and the upper Waria Valley near Garaina, have potential for agricultural development, given the high to very high potential land and lack of agricultural pressure. However, access to markets in both places is difficult and shipping costs are high. The moderate to high potential areas in the Markham, Wanut and Bulolo valleys and along the Morobe Coast are well suited to agricultural development given the good access to markets in Lae. Betel nut, fresh food, cocoa and copra are established smallholder cash-earning activities in these areas.
The most disadvantaged people in the province are the small number of people living in the Sarawaget Range who earn very low incomes, have poor access to services and live in a low potential environment. They have few opportunities to improve their livelihoods. In the Menyamya area and on the Huon Peninsula, large numbers of people are adversely affected by poor environments and very low incomes. Areas around Imane, Engari, Yaamu and east of Menyamya have similar problems but fewer people are affected. People living in the Garaina and Finschhafen areas and on Umboi Island have very low incomes. Small numbers of people south of Tepte and on the coastal plains around Finschhafen are constrained by strong agricultural pressure and very low incomes, while those in the Wotut and Snake valleys live in low potential environments.
**Population**

The estimated rural population in the year 2000 is 40,000. Much of the district is made up of rugged, uninhabited mountains. The highest population densities are in the Snake Valley with 80 persons/km². The Maiinyanda area in the upper Watur Valley has a density of 46 persons/km², while the Wau area has 24 persons/km². All other areas in the district have low densities with an average of 15 persons/km². The upper Watur and Bulolo valleys have significant in-migration with settlers renting land along the Wau Road where they have access to markets on the Highlands Highway and in Lae. The population of the Upper Watur census division increased by 4.6 per cent per annum between 1980 and 1990.

**Access to services**

There are clear contrasts in access to services between the north and south of the district. The road from Wau and Bulolo to Lae is sealed. A gravel surfaced road runs west from near Bulolo to Menyamanda and another goes northeast from Mumeng to Waguna in the upper Snake Valley. A road in the Waria Valley north and south of Garaina has no external connections. People in the Watur, Snake and Bulolo valleys are within four hours of a service centre, and have good access to Lae and the Highlands Highway. In contrast, people in the upper Warat Valley, Waria Valley and the mountains to the north and south, require up to eight hours travel to reach the nearest service centre.

**Income**

Incomes are high in the Snake Valley from the sale of fresh food, particularly green vegetables, and from coffee. In the Watur and Bulolo valleys, people earn low to moderate incomes from the sale of betel nut, fresh food and coffee. In the upper and lower Watur Valley, upper Bulolo Valley, Kuper Range, Kodama Range and Waria Valley, incomes are very low. Wage employment and royalties are provided by mining and forestry operations near Wau and Bulolo respectively; and, to a lessor extent, from a disused tea plantation at Garaina.

**Subsistence agriculture and nutrition**

Agriculture in the Bulolo and Watur valleys is dominated by moderate intensity banana production, extending south from the Markham Valley. Triploid bananas produce for up to 20 years from one planting. People in the Snake Valley, upper Watur Valley, Kuper Range, Kodama Range and Waria Valley cultivate low intensity sweet potato gardens. Soil retention barriers and mounds are used in these areas. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as poor; 63 per cent of children were stunted and five per cent were seriously under weight.

**Land potential**

The land potential in the Waria Valley around Garaina is high to very high. The Snake, Bulolo and upper Watur valleys have low to moderate potential constrained by low rainfall and a long dry season. The lower Watur Valley has low potential caused by steep slopes, poor soils and a long dry season. The southern mountains have low to moderate potential due to steep slopes, frequent cloud cover and low temperatures at higher altitudes.

**Agricultural pressure and potential**

There is moderate agricultural pressure on land in the lower Watur Valley, resulting from moderate intensity agriculture being practised in poor environments. There is potential for agricultural development in the Waria Valley where the land potential is high to very high, and parts of the valley are unoccupied. However, access to markets is very poor. Moderate land potential occurs in the Bulolo Valley. Here, there is potential for development given the good access to markets. The dry, seasonal climate is well suited to various fruit crops such as mango.

**Disadvantaged people**

The most disadvantaged people in the district are the small populations of the upper Bulolo Valley, Kuper Range and Kodama Range, where incomes are very low and the environment is poor. These people have few opportunities to improve their livelihoods. The very small number of people living in the Waria Valley have very low incomes. However, the environment offers some potential for development. Overall, people in Bulolo District are slightly disadvantaged relative to people in other districts of PNG. There is little agricultural pressure, land potential is moderate, access to services is good and cash incomes are moderate.
**Finschhafen District** is located at the eastern end of the Huon Peninsula and includes the Cromwell Mountains and valleys of the Song, Mape, Mongi, Kua and Bulum rivers. A narrow limestone plain interspersed with narrow floodplains extends along the coast from Cape Sibida in the north, to Mango Point in the south. This gives way to rugged inland mountains. Average annual rainfall ranges between 2400 and 3700 mm, increasing from west to east. Altitude varies from sea level to over 3000 m in the Cromwell Mountains.

**Population**

The estimated rural population in the year 2000 is 36,000. The highest population densities of 35 persons/km² occur in the mountain valleys of the Mongi, Kua and Bulum rivers. The coastal plains and valleys around Finschhafen have densities of 21 persons/km².

**Access to services**

Accessibility is moderate over the whole district with most people living within eight hours of Finschhafen. A road runs along the coast from Finschhafen to Sialum. Another runs inland from Finschhafen to Pindiu, but there is no road connection to Lae. Small boat travel is common along the coast, but is dangerous between December and March. There is a daily passenger shipping service from Finschhafen to Lae.

**Income**

Incomes are uniformly very low across the district. Cash is earned from minor sales of fresh food and betel nut in coastal areas, and coffee in the mountains.

**Subsistence agriculture and nutrition**

Agriculture in the inland mountains is characterised by low intensity sweet potato production. People on the coastal hills and plains cultivate low intensity Chinese taro gardens. In the mountains, one planting is made before a fallow period of 1–4 years. Soil retention barriers are used to combat erosion. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as serious; 36 per cent of children were stunted and 11 per cent were seriously under weight.

**Land potential**

The land potential in the coastal valleys is moderate due to poor soils and high rainfall. The inland Mongi and Kua valleys have moderate potential due to steep slopes and frequent cloud cover. The Mindik, Ogeranang and Lengbati areas have low potential caused by steep slopes, poor soils and frequent cloud cover. The coastal plains have low potential constrained by high rainfall and a long dry season.

**Agricultural pressure and potential**

There is moderate agricultural pressure on the narrow coastal plains around Finschhafen and large areas of marginal pressure in the Busiga, Go, Mape and Song valleys. These valleys have some potential for agricultural development given the moderate land potential and nearby roads to Finschhafen. However, transport beyond Finschhafen is by sea, and shipping costs are high. The inland Mongi and Kua valleys also have moderate land potential and reasonable access to Finschhafen.

**Disadvantaged people**

The most disadvantaged people in the district are those in the Bulum Valley around Lengbati, Ogeranang and Mindik, where environments are unproductive and incomes are very low. Small numbers of people on the coastal plains around Finschhafen are constrained by moderate agricultural pressure and very low incomes. All other people in the district have very low incomes. Overall, people in Finschhafen District are extremely disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is low, access to services is moderate and cash incomes are very low. Child malnutrition is of concern.
Huon Gulf is the largest district in the province. It includes the lower Markham, Watut and Rumu valleys (near Chivasing) in the north, and the Morobe coastal plains and mountains which extend from Lae to the Oro Province border. Average annual rainfall ranges from 1700 mm in the Markham Valley, to over 3700 mm south of Lae. Rainfall increases towards the southeast and there is a long dry season. Altitude varies from sea level to over 2500 m in the Bowutu Mountains.

**Population**

The estimated rural population in the year 2000 is 32,000. The highest population density is northwest of the Chivasing area with 33 persons/km². The Morobe Coast has a density of 24 persons/km², while the Markham and Watut valleys have 13 persons/km². The Engati area, west of the Watut Valley, has a very low population density of 5 persons/km². The Markham Valley has significant in-migration of people looking for better access to services and wage employment around Lae. The population of the Lei Wompa census division increased by 4.7 per cent per year between 1980 and 1990. The upper Francisco Valley, inland of Salamaua, has significant out-migration of people.

**Access to services**

The Highlands Highway runs through the lower Markham Valley in the north of the district, but there are no roads that serve the Watut Valley and the Morobe Coast. Nevertheless, most people in the district are within a day’s travel of a service centre.

Small boat travel is common along the Morobe Coast, but is dangerous between December and March. People in the Watut Valley use rafts to transport produce to markets which are located on the highway north of the Markham River.

**Income**

People in the northern part of the district, in the Markham and Watut Valleys, earn very high incomes from the sale of fresh food and betel nut. Along the Morobe Coast, incomes are moderate to low from the sale of betel nut, coconut, fish and fresh food, much of which is transported by boat to markets in Lae. People in the Engati area and north of Chivasing have very low incomes derived from minor sales of coffee and betel nut.

**Subsistence agriculture and nutrition**

People in the Markham and Watut valleys cultivate moderate intensity banana gardens. Coconut is also an important food. Triploid bananas will produce for up to 20 years under optimal management. Food production in the rest of the district is characterised by low intensity sweet potato cultivation, though taro is also an important food on the Morobe Coast. Only in the very upper Rumu and Irumu valleys is Chinese taro the most important crop. Soil retention barriers are used in these areas. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as fair; 12 per cent of children were stunted and four per cent were seriously under weight.

**Land potential**

Moderate to high potential land is restricted to small and scattered areas in the district. The Markham and Watut valleys are limited by poor soils, frequent flooding and a long dry season. There are steep slopes and frequent cloud cover in the Engati area. The Morobe Coast has moderate potential and is limited in places by frequent flooding or steep slopes. The upper Francisco Valley has low potential constrained by steep slopes and frequent cloud cover.

**Agricultural pressure and potential**

There are large areas of moderate and marginal agricultural pressure in the Markham and Watut valleys. Marginal pressure areas will be of concern only if agriculture intensifies without the adoption of suitable management practices. There is potential for agricultural development in small areas of the Markham Valley that have moderate potential land and good access to markets. The Morobe Coast has some potential for agricultural development but sea transport to markets is expensive.

**Disadvantaged people**

The most disadvantaged people in the district are the very small number of people living in the Engati area, where incomes are very low and the environment is poor. There is moderate agricultural pressure in parts of the Markham Valley and with steady in-migration to these areas, people may become vulnerable to the effects of land degradation and declining crop yields. Overall, people in Huon Gulf District are moderately disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is low, access to services is moderate and cash incomes are moderate.
Kabwum District is located on the northern side of the rugged Sarawaget Range and includes the valleys of the Yupna, Urawa, Som, Timbe and Kwama rivers. Average annual rainfall ranges between 2000 and 2600 mm, increasing from west to east. There is a long dry season. Altitude varies from sea level at Sareuak Bay to over 4000 m on the Sarawaget Range. Most people live between altitudes of 800 and 2000 metres.

**Population**

The estimated rural population in the year 2000 is 43,000. High population densities occur in this district, especially at higher altitudes. The highest densities are around Kabwum, Konge, Derim and Yulamet with 100 persons/km². The upper Yupna Valley near Teptep, has a density of 67 persons/km², while the lower Kwama and Kari valleys have 21 persons/km². The upper Urawa and Som valleys, around Denanget, Yawan and Sapananga, have low densities of 17 persons/km².

**Access to services**

A road from the coast at Wasu (in Tewai-Siasi District) to Kabwum means that the majority of people in the district have access to a service centre within eight hours’ travel. However, people around Denanget, Yawan and Sapananga require more than one day’s travel. Small boats are used to travel beyond the district to Sialum, Finschhafen and Lae, but sea travel is dangerous, especially during the wet season from around December to March.

**Income**

Isolation from main centres means incomes are very low to moderate throughout the district. Incomes are derived from minor sales of fresh food and coffee in the upper valleys around Kabwum, and cocoa, coconut and fresh food on the coast around Wasu.

**Subsistence agriculture and nutrition**

Agriculture in the upper Yupna, Urawa, Som, Timbe and Kwama valleys is characterised by low intensity sweet potato production. Soil is tilled and soil retention barriers are used. People in the lower valleys cultivate low intensity Chinese taro gardens. Agricultural intensity is relatively high around Teptep, where people cultivate moderate intensity sweet potato gardens. There are 6–14 consecutive plantings after fallow periods of 5–15 years. Sweet potato is grown on composted ridges. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as serious; 73 per cent of children were stunted but only one per cent were seriously under weight.

**Land potential**

There is no high or very high potential land in the district. In the upper Kwama Valley, steep slopes and frequent cloud cover limit potential. On the coast, poor soils and a long dry season constrain potential. The lower Yupna, Urawa, Som, Timbe and Kwama valleys have low potential due to steep slopes, a long dry season and frequent cloud cover. The upper valleys, apart from very limited areas of deeper volcanic soils around Teptep, have very low to low potential caused by steep slopes, frequent cloud cover and low temperatures.

**Agricultural pressure and potential**

Strong agricultural pressure exists around Teptep because moderate intensity agriculture is practised in a low potential environment. There is a small area of moderate pressure in the lower Urawa Valley. There is limited potential for agricultural development in the district given the low to moderate potential environments and poor access to markets.

**Disadvantaged people**

The most disadvantaged people in the district are the small numbers southeast of Teptep who are constrained by strong agricultural pressure and very low incomes. People here are vulnerable to the effects of declining crop yields, food and food shortages, and have limited cash to purchase supplementary food. Small numbers of people in the Denanget, Yawan and Sapananga areas are constrained by poor access to services, low cash incomes and low potential environments. People in the upper Yupna Valley and lower Urawa, Som, Timbe and Kwama valleys have low potential environments and very low incomes. Most people in the district have few opportunities to improve their livelihoods. Overall, people in Kabwum District are seriously disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is low, access to services is moderate and cash incomes are moderate. Child malnutrition is of concern.
Morobe Province

Markham District

Markham District is dominated by the plains and floodplains of the upper Ramu and Markham valleys. The north of the district includes the Sarawaget Range and valleys of the Leron, Mami, Ufim, Ikwap and Wontoap. The south of the district includes the Wahi and Wantoat valleys. Average annual rainfall ranges between 1600 and 2300 mm, with a long dry season. Altitude varies from 150 m in the Markham Valley, to over 3500 m on the Sarawaget Range.

Population

The estimated rural population in the year 2000 is 41 000. The highest population densities are around Wantoat, Yausuru and Imane with an average of 80 persons/km². The Markham and Ramu valleys have densities of 47 persons/km²; while the Leron, Wontoat and Ikwap valleys have 33 persons/km². The Ufim and Mami valleys have low densities of 13 persons/km², while the Mafi Valley has 5 persons/km². Over half of the district is unoccupied.

Access to services

The Highlands Highway runs through the centre of the district. As a result, people in the Markham, Ramu and lower Leron valleys are within four hours’ travel of Lae. People in the mountain valleys to the north are within eight hours’ travel of Lae. There is a good, but steep and narrow road through the Leron Valley to Wantoat. Accessibility is worst in the south of the district, around Imane and Yasuru.

Income

People in the Markham and Ramu valleys have excellent access to markets in Lae and the highlands, and consequently earn very high incomes from the sale of betel nut and fresh food. People in the remainder of the district have very low to low incomes derived from minor sales of betel nut, fresh food and, at higher altitudes, coffee.

Subsistence agriculture and nutrition

Agriculture in the Markham and Ramu valleys is dominated by moderate intensity banana production. Coconut is also an important crop. Land improvement practices such as peanur rotations, tillage and mounding are used. People in the lower Leron Valley cultivate low intensity banana gardens, but employ few land improvement practices. North of the highway, in the upper Leron, Wontoat and Ikwap valleys, low intensity gardens of Chinese tapioca dominate. Soil retention barriers and mounding are common. Low intensity sweet potato gardens dominate south of the highway. Agricultural intensity is higher around Imane and Yasuru. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as serious; 36 per cent of children were stunted and 10 per cent were seriously under weight.

Land potential

The land potential in the Markham and Ramu valleys is moderate to high, limited by a long dry season. The valleys in the Sarawaget Range have low to moderate potential constrained by steep slopes, a long dry season and frequent cloud cover. The Wahi and Wantoat valleys have very low to moderate potential due to steep slopes, a long dry season, poor soils and frequent cloud cover.

Agricultural pressure and potential

Strong agricultural pressure occurs around Wantoat as a result of moderate intensity agriculture being practised in low potential environments. This area is vulnerable to various forms of land degradation. There are minor areas of moderate pressure around Yasuru and Imane and more significant areas of marginal and moderate pressure in the Markham Valley. Marginal pressure areas will be of more concern in the future if agriculture intensifies without the adoption of suitable management practices. There is potential for agricultural development in some areas of the Markham and Ramu valleys given the moderate to high land potential and good access to markets. Betel nut and fresh food are established smallholder cash-earning activities in these areas.

Disadvantaged people

The most disadvantaged people in the district are those north of the highway in the mountain valleys of the Sarawaget Range. People in these areas are constrained by very low incomes and low potential environments. The very small number of people who live around Yasuru and Imane are constrained by very low incomes and moderate agricultural pressure. They have few opportunities to improve their livelihoods. People living in parts of the Markham Valley are constrained by moderate agricultural pressure. Overall, people in Markham District are slightly disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is moderate, access to services is good and cash incomes are high. Child malnutrition is of concern.
Menyamya District is located across the main mountain divide of Papua New Guinea. The district includes the headwaters of the Tauri River, which flows south to the Gulf of Papua, and the Watur River, which flows north to the Bismarck Sea. Average annual rainfall ranges between 2000 and 2800 mm, with a moderate dry season. Altitude varies from 600 m in the Banir Valley, to over 3200 m on Marble Peak. Most people live between altitudes of 600 and 2000 metres.

Population
The estimated rural population in the year 2000 is 55,000. The highest population densities are in the Tauri, Yakwoi and Langimar valleys with 46 persons/km². The Kabu and Kapau valleys have a density of 39 persons/km², while the Kariba Valley has 24 persons/km². The area north of Menyamya, towards Engari, has a very low density of 5 persons/km². The upper Tauri Valley and the area to the north of Menyamya have significant out-migration. The population of the North Menyamya census division decreased by 1.3 per cent per year between 1980 and 1990.

Access to services
Most people in the district travel for up to eight hours to reach the nearest service centre. The Wau Road is surfaced, proceeding from Wau to Menyamya and Aseki to Bulolo. A very rough road continues from Menyamya west to Marawaka in Eastern Highlands Province.

Income
Incomes are uniformly very low across the district, and are earned from minor sales of coffee and fresh food. Poor access and low potential environments are major constraints to improving incomes.

Subsistence agriculture and nutrition
People in most areas of the district cultivate very low intensity sweet potato gardens. Agriculture on the narrow plains of the Yakwoi Valley, between Kwapalim and Menyamya, is more intensive and is dominated by moderate intensity sweet potato production. Here, there are 15–40 consecutive plantings before a fallow period of around 15 years. Production is maintained through the use of land improvement practices such as legume rotations, composting, drainage, tillage and bedding. In contrast, people in the Tauri and Langimar valleys cultivate low intensity sweet potato gardens. Tillage and mounding are used in these areas. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as serious; 72 per cent of children were stunted and five per cent were seriously under weight.

Land potential
The land potential on the narrow plains of the Yakwoi and Tauri valleys, near Menyamya, is high to very high, but this is only a small section of the district. Intensive land improvement practices overcome constraints caused by poor soil. Other parts of the Tauri and Yakwoi valleys have moderate potential due to poor soils and steep slopes. The Langimar Valley has moderate potential constrained by steep slopes and frequent cloud cover. The Kariba, Kabu and Kapau valleys, and the area to the north, have low potential land constrained by steep slopes and frequent cloud cover.

Agricultural pressure and potential
The measures used in this book indicate that there is little agricultural pressure on land in this district. However, child malnutrition and the conversion of large areas of forest to grassland suggest that there is some pressure on land. There is some potential for agricultural development in the Tauri and Yakwoi valleys around Menyamya, where there is moderate to very high potential land and reasonable access to markets via the road to Bulolo and Lae. Coffee is a recently established smallholder cash-earning activity in these areas, but the area under cultivation is very small.

Disadvantaged people
The majority of people in the district are constrained by very low incomes and low potential environments. They have few opportunities to improve their livelihoods. Overall, people in Menyamya District are extremely disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is low, access to services is moderate and cash incomes are very low. Child malnutrition is of concern.
Nawae District covers the Bukaua coastal plains and valleys of the Bunga, Busu, Busem, Sankwep, Nimba, Tiumbi, Yanem, Bunbok, Nambuk, Gusap and Erap rivers, in the Rawlinson and Sarawaget ranges. Average annual rainfall ranges from 2000 mm in the lower Erap Valley, to over 4200 mm on the Bukaua Coast. There is a long dry season in most areas. Altitude varies from sea level to over 4000 m on the Sarawaget Range.

Population

The estimated rural population in the year 2000 is 30,000. Population densities are highest in the Bunbok and Gusap valleys with 40 persons/km², while in the Erap and Nambuk valleys densities are 31 persons/km². The Bukaua Coast and Busu, Sankwep, Nimba, Tiumbi and Yanem valleys have densities of 24 persons/km². Significant outward migration is occurring from the upper Busu Valley.

Access to services

Access to services in the district is reasonable and all villages are within eight hours' travel of Lae. There is a road from Lae running along the Bukaua Coast, but it is frequently closed due to flooded river crossings. Another road runs from Lae to Kwpaiyek Village and Hobu School in the Busu Valley. The Busua area is linked to a road from the Highlands Highway in the Markham Valley. Small boat travel is common along the coast.

Income

Incomes along the Bukaua Coast are moderate and are derived from sales of betel nut, cocoa, coconut, fish and fresh food. In the Boana area and the Erap, Nambuk and Gusap valleys, people earn low incomes from sales of fresh food, coffee, betel nut and tobacco. In the more distant inland valleys, very low incomes are derived from minor sales of coffee, fresh food and potato.

Subsistence agriculture and nutrition

On the Bukaua Coast, agriculture is dominated by low intensity sweet potato and taro cultivation. In the Erap and Nambuk valleys, moderate intensity Chinese taro and sweet potato gardens dominate. In these valleys people make two consecutive plantings after fallow periods of 5-15 years. Gardens in the Busu Valley are similar but less intensive, with only one planting after fallow periods of 15 years. In the 1982-83 National Nutrition Survey, malnutrition in children under five years was assessed as poor; 67 per cent of children were stunted and seven per cent were seriously under weight.

Land potential

Land potential in the district is mostly low to moderate. In the upper Erap Valley, potential is limited by steep slopes, a long dry season, frequent cloud cover and low temperatures at higher altitudes. The upper Busu Valley has steep slopes, poor soils and frequent cloud cover. The lower Busu Valley has moderate to high potential constrained mainly by steep slopes. The Bukaua coastal plains have low potential due to high rainfall and frequent flooding.

Agricultural pressure and potential

Moderate and marginal agricultural pressure exists in the upper Erap Valley due to moderate intensity agriculture being practised in low potential environments. Marginal pressure areas will be of more concern in the future if agriculture intensities without the adoption of suitable management practices. There is potential for agricultural development in the lower Busu Valley, where moderate to high potential land occurs with little to no agricultural pressure and good access to markets. There is some limited potential for agricultural development in the Erap, Gusap and Nambuk valleys given the moderate land potential and reasonable access to markets.

Disadvantaged people

The most disadvantaged people in the district live in the upper valleys of the Busu River, where environments are unproductive and incomes are very low. These people have few opportunities to improve their livelihoods. People in the upper Erap Valley are constrained by moderate agricultural pressure, while those on the Bukaua coastal plains live in low potential environments. Overall, people in Nawae District are seriously disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is low, access to services is moderate and cash incomes are low.
Tewai-Siassi District includes both the mainland along the north coast of the Huon Peninsula, and the offshore islands of Umboi, Tokolowa, Sakar, Malai and Tiuan. The north coast consists of mountain valleys, floodplains and raised coral terraces. Average annual rainfall ranges from 2200 mm around Wasu, to over 3500 mm on Umboi Island. There is a long dry season in most areas. Altitude varies from sea level to over 2000 m on Mt Bulebe.

Population
The estimated rural population in the year 2000 is 30,000. The highest population densities are on Malai and Tiuan islands with 430 persons/km$^2$. These are some of the highest densities in PNG. The south coast of Umboi Island also has very high densities of 118 persons/km$^2$. On the mainland, along a narrow strip of land on the Sialum coastal plains, densities are 102 persons/km$^2$. The area around Wasu has a density of 68 persons/km$^2$. The inland valleys of the Huon Peninsula, the west coast of Umboi Island and Sakar Island have lower densities of 25 persons/km$^2$, while Tokolowa Island and the plains around Singorokai have an average of 15 persons/km$^2$.

Access to services
People everywhere in the district are within eight hours’ travel of a service centre. There is a road from Finschhafen to Sialum and Kelanoa, but it is sometimes blocked by flooded rivers during the wet season. Small boat travel is used along the coast, but the Viria Strait is subject to rough seas that make small boat travel between the islands and mainland dangerous, especially during the wet season. In the late 1990s there was a regular passenger shipping service between Umboi Island and Finschhafen.

Income
Cash incomes are very low throughout the district and are derived from sales of fresh food, fish, betel nut, cocoa and coconut. Forestry operations on Umboi Island provide minor and transitory wage employment and royalties.

Subsistence agriculture and nutrition
Agriculture in the inland valleys of the Huon Peninsula is characterised by low intensity Chinese taro production. Low intensity yam gardens are cultivated by people on the coastal plains between Wasu and the border with Finschhafen District, and also on Tokolowa Island and the northwest coast of Umboi Island. Agriculture on Sakar Island, and on the northwest coast and inland areas of Umboi Island, is characterised by low to moderate intensity sweet potato production. On the southwest coast of Umboi Island, sugo is the most important food. People on Malai and Tiuan islands cultivate very high intensity gardens, dominated by cassava and sweet potato. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as poor; 37 per cent of children were stunted and seven per cent were seriously under weight.

Land potential
The only high potential land in the district is found along the coast of Umboi Island, where rainfall, soils, slope, temperature and light are ideal for the production of many crops. The south coast of Umboi Island has high potential land that is limited by either high rainfall or steep slopes. Tokolowa, Sakar, Malai and Tiuan islands have low potential land due to steep slopes and a long dry season.

On the mainland, the coastal plains have moderate potential constrained by poor soils and a long dry season, while the inland valleys have steep slopes, poor soils and frequent cloud cover.

Agricultural pressure and potential
Strong agricultural pressure exists on Tiuan and Malai islands where high intensity agriculture occurs in moderate potential environments. There is moderate pressure in the lower altitude hills above Wasu and areas of marginal pressure inland of Sialum. There is potential for agricultural development on Umboi Island given the high to very high potential environments and lack of agricultural pressure. However, access to markets is by ship and is expensive. The coastal plains around Sialum have some potential for development that is constrained by poor access to markets. A number of fruit crops, including mango, are well suited to the seasonally dry climate.

Disadvantaged people
The most disadvantaged people in the district are the small number on Malai and Tiuan islands, where very high population densities occur together with strong agricultural pressure and very low incomes. Development in the inland valleys of the Huon Peninsula and on Sakar Island is constrained by poor environments, very low incomes and, in some places, moderate agricultural pressure. All other people in the district have very low incomes. Overall, people in Tewai-Siassi District are seriously disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is moderate, access to services is moderate and cash incomes are very low.
Madang Province

Children and houses near Madang. The peri-urban areas around Madang town have significant in-migration of settlers from Madang, East Sepik, Eastern Highlands and Simbu provinces. These people seek better access to services and wage employment. Over time the settlement areas have become more formalised with permanent buildings and connections to town water and electricity. There has been, and continues to be, significant migration to rural areas adjacent to the major towns in the country. Smaller urban areas associated with mines also have high in-migration.

Intensive sweet potato gardens in the Teptep area. Intensive agriculture in an environment characterised by low temperatures, excessive cloud cover and poor soils has resulted in strong agricultural pressure in the high altitude Teptep area. People are vulnerable to declining crop yields, frost and food shortages, and have limited cash to purchase supplementary food. Poor access to markets limits opportunities for people to improve their livelihoods. Sweet potato yields are maintained by composting, one of the few locations where this is practised outside of the western part of the highlands.
Madang occupies 28,000 km² in the central north of the PNG mainland. The province has a diverse range of environments, from the top of Mt Wilhelm, the highest peak in PNG, to the coast. Areas include the mountains of the Adelbert, Finisterre and Bismarck ranges, the extensive floodplains of the Ramu Valley, the coastal limestone plains from Bougainville to Saidor, the dry seasonal hills inland of Bougainville and the volcanic offshore islands. Manam, Karkar and Long islands are active volcanoes that present a serious hazard to people living on them. Altitude ranges from sea level to over 4000 m on the slopes of Mt Wilhelm. The Bismarck Fall has a vertical drop of 4300 m from the summit of Mt Wilhelm to the Ramu Valley, over a distance of only 45 kilometres. This relief is similar to the Himalaya Mountains. Average annual rainfall varies from 2000 mm around Bougainville, to more than 4000 mm in the Ramu Valley and Bismarck Fall, with a moderate to long dry season in the northwest and southeast of the province. The six districts in the province are Bogia, Madang, Middle Ramu, Rai Coast, Sumkar and Usino-Bundu.
The estimated rural population of Madang in the year 2000 is 251,000, which is six per cent of the national rural population. The provincial population growth rate is 1.6 per cent per year. Population densities are highest on Karkar, Boisa, Manam and Bagabag islands with an average of 110 persons/km². The Gogol Valley and coastal plains around Madang have 68 persons/km². Areas around Bundi, Simbai and Teptep have an average of 34 persons/km², while the rest of the province has low densities of 14 persons/km².

More than half of the province is unoccupied. The Aiome area and coastal plains from Cape Gourdon to Madang have significant in-migration. The Simbai area and the upper Ramu Valley around Bundi, Brahman and Walium have significant out-migration.
Madang is connected to Lae, Goroka and Mt Hagen by the Ramu and Highlands highways. The road from Madang to Lae is mostly sealed. A partly sealed road runs north along the coast from Madang town to Bogia and the Ramu River. A road of lesser quality extends inland from Bogia to Josephstal. A good quality road runs from the Ramu Highway at Bogadjim to Saidor along the Rai Coast, but the numerous rivers are not bridged and are dangerous to cross during the wet season. There is a bridge over the Ramu River at Brahman, linking Bundi with Madang. People travel from the islands to the mainland by sea and air. Boat travel is common between the islands and along the coast. People on the coastal plains around Madang require less than one hour’s travel to reach Madang town, while people in the coastal hills and in the Gogol Valley require less than four hours’ travel.

People in all other areas require between 4–8 hours’ travel to reach the nearest service centre, except those west of Simbai who are very remote and require more than one day’s travel.
Agriculture provides the main source of cash income in the province. Cocoa, betel nut, copra and fresh food are the most important smallholder cash crops. Other sources of income include fish, firewood, coffee and tobacco. Incomes are high on Karkar Island and along the coastal plains, while people in the rest of the province have very low to moderate incomes. There is a clear relationship between cash income and access to markets. There are numerous non-agricultural sources of income in the province, including wage employment at the Ramu Sugar estates, the site for the new Ramu nickel mine and the Gogol and Josephstaal forestry operations. Wage employment and business activities around Madang town are also important sources of income.
Agriculture in the province is diverse. On the Rai Coast and on Karkar Island, people cultivate low intensity mixed staple gardens. Common crops include taro, Chinese taro, yam, banana, sweet potato and coconut. Here, there are two consecutive plantings before a fallow period of 5–15 years. People in the Ruboni Range and in coastal areas of Bogia District cultivate low intensity taro and yam gardens. Near Bogia, people use very small pockets of alluvial soils for moderate intensity sweet potato and yam production. Sago is the most important food in the middle and lower Ramu Valley, and is supplemented by low intensity mixed staple cultivation. In the Gogol and upper Ramu valleys, people make low intensity banana gardens, with either Chinese taro or sweet potato as co-dominant staple crops. The remainder of the province is characterised by low intensity sweet potato cultivation.
The highest potential land is found on Karkar Island. This land has no environmental constraints and is among the most productive in PNG. Rainfall, slope, temperature, soils and light are ideal for the production of many crops. However, Karkar Island is an active volcano. The coastal hills, inland of Madang, have high potential with no constraints. The coastal plains have moderate potential limited by poor soils. The Sogeram Valley, Ruboni Range, and upper Ramu Valley have moderate land potential, while the rest of the province has either very low or low potential. Common constraints are steep slopes, high rainfall, frequent cloud cover, seasonal flooding, low temperatures and a long dry season.
There is a small area of strong agricultural pressure around Teptep as a result of the intensive production of sweet potato in a very low potential environment. The Gogol Valley and coastal plains, north of Madang, have some areas of moderate agricultural pressure and there is marginal pressure inland of Bogia, on Manam Island and in the upper Gogol Valley. The highest potential land in the province is on Karkar Island and is already intensively used for smallholder and plantation cocoa and coconut production. Other high and moderate potential areas offer opportunities for development. Examples include the coastal plains, hills and valleys where road access to markets is very good, and the Bogia and Sogarom areas where road access is improving. Cocoa, betel nut and fresh food production are established smallholder cash-earning activities in these areas.
The most disadvantaged people in the province are those in the Schrader Range west of Simbai, where small numbers of people live in low potential environments, earn very low incomes and have poor access to services. Smaller numbers of people around Tepet experience strong agricultural pressure and earn very low incomes. People in these areas are vulnerable to the effects of land degradation, declining crop yields and food shortages, and have limited cash to purchase supplementary food. People in the Bisnack Range, in the Ramu and lower Simbai valleys, in the Bundi area, and on the Adelbert and Finisterre ranges earn very low incomes and live in low potential environments. People in the Sogarum Valley and along the Rai Coast have very low incomes.
Bogia District is dominated by the floodplains of the lower Ramu River, the hills of the Ruboni Range and the mountains of the Adelbert Range. Raised coral limestone plains extend from Hansa Bay along the coast to the eastern border of the district. Manam Island, an active volcano, is 15 km off the coast, as is the smaller Boisa Island. Average annual rainfall ranges between 2000 and 3000 mm and decreases from north to south. There is a long dry season. Altitude in most of the district is below 300 m with a few peaks such as Mt. Uvo exceeding 800 metres.

Population
The estimated rural population in the year 2000 is 46,000. Boisa Island has the highest population density with 230 persons/km². Manam Island also has a very high density of 120 persons/km². The remainder of the district averages 20 persons/km². The Ramu floodplain and Adelbert Range are largely unoccupied. The coastal plains east of Cape Gourdon have significant in-migration. The population of the Ulingan census division increased by four per cent per year between 1980 and 1990.

Access to services
Most people in the district are within 4–8 hours’ travel of Madang town. A good road links Bogia to Madang, while a more recent road runs south from Bogia to Josephstaal.

Income
Incomes are very low to low in the entire district and are derived from minor sales of fresh food, cocoa and copra.

Subsistence agriculture and nutrition
Agriculture in the Ruboni Range and in the valleys of the Adelbert Range is characterised by low intensity taro and yam cultivation. People on the Ramu floodplain depend on sago production which is supplemented by coconut and low intensity mixed staple gardens on higher ground. Much of this land is flooded every year by the seasonal rise of the Ramu River. On Manam Island, people cultivate low intensity sweet potato and taro gardens. Agriculture on the coastal plains of the mainland is dominated by moderate intensity sweet potato and yam gardens. Here, there are 3–5 consecutive plantings before a fallow period of 5–15 years. Drainage, tillage and small mounds are used to improve land productivity. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as poor; 27 per cent of children were stunted and nine per cent were seriously underweight.

Land potential
The land potential on Manam Island and in the Ruboni Range is moderate due to steep slopes and a long dry season. However, Manam is an active volcano and in the last 40 years people have twice been evacuated from the island during eruptions. The coastal plains have low to moderate potential which could be significantly improved if drainage and soil fertility constraints are overcome. The Ramu floodplain has very low to low potential because of annual flooding and poor soils. However, isolated flood-free levees and terraces have good soils and high potential. The Adelbert Range has low potential due to steep slopes, frequent cloud cover and poor soils.

Agricultural pressure and potential
There is marginal agricultural pressure inland of Bogia and on Manam Island. These areas will be of more concern if agriculture continues to intensify in the absence of suitable management practices. The best opportunities for agricultural development are in the Ruboni Range and coastal plains, where there is moderate land potential and relatively good access to markets. The development of smallholder cocoa production is a strong possibility given that the cocoa industry is already established in the province and is supported by research and extension activities. Fresh food and betel nut are also established smallholder cash-earning activities in these areas.

Disadvantaged people
The most disadvantaged people in the district are those on the Ramu floodplain who are constrained by very low incomes and low potential environments. Overall, people in Bogia District are moderately disadvantaged relative to people in other districts of PNG. There is little agricultural pressure, land potential is moderate, access to services is moderate and cash incomes are low.
Madang District surrounds Madang town and covers the mountains and hills of the Adelbert Range, the Gogol Valley, the upper Sogeram Valley and the coastal limestone plains. Average annual rainfall ranges between 3200 and 3600 millimeters. Altitude varies from sea level to over 1200 m at the top of the Adelbert Range. People live as high as 800 metres.

Population
The estimated rural population in the year 2000 is 34,000. The coastal plains and Gogol Valley have high population densities of 68 persons/km². The coastal hills have an average density of 14 persons/km², while the Adelbert Range and upper Sogeram Valley are sparsely populated with 7 persons/km². The coastal plains have significant in-migration, particularly the peri-urban area around Madang. The population in the North Ambenob census division increased by 4.3 per cent per year between 1980 and 1990.

Access to services
People on the coastal plains require less than one hour’s travel to reach Madang town, while those in the coastal hills and Gogol Valley are within four hours’ travel. People in the Adelbert Range and upper Sogeram Valley require up to eight hours’ travel to reach the nearest service centre. The north coast road runs from Madang to Bogia and connects to numerous branch roads which run into the coastal hills. The road to Lae passes through the low saddle between the Adelbert and Finisterre ranges into the Ramu Valley.

Income
Incomes are high on the coastal plains and are derived from the sale of cocoa, copra, betel nut and fresh food. In the Gogol Valley and on the coastal hills, people earn moderate incomes from sales of fresh food and cocoa. Those in the Adelbert Range and upper Sogeram Valley earn very low incomes from minor sales of betel nut and fresh food.

Subsistence agriculture and nutrition
Agriculture on the coastal plains is dominated by moderate intensity taro and yam cultivation. There are two consecutive plantings before a fallow period of 1–4 years. People in the Adelbert Range and upper Sogeram Valley cultivate low intensity sweet potato and taro gardens, while those in the Gogol Valley make low intensity banana and Chinese taro gardens. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as poor; 47 per cent of children were stunted and two per cent were seriously under weight.

Land potential
The land potential in the coastal plains is high, but is restricted by steep slopes. The coastal plains have moderate land potential that could be improved through better management of drainage and soil fertility. The Gogol and upper Sogeram valleys have low to moderate land potential due to poor soils, high rainfall and annual flooding along the floodplains. The Adelbert Range has low to moderate potential caused by steep slopes, frequent cloud cover and poor soils.

Agricultural pressure and potential
There is moderate agricultural pressure on land in the lower Gogol Valley and on the coastal plains around Madang. There is marginal pressure in the upper Gogol Valley, however, this will only be of concern in the future if agriculture intensifies without the adoption of suitable management practices. The best opportunities for agricultural development are in the coastal hills and plains where there is moderate to high land potential and good access to markets. The upper Sogeram Valley has moderate potential but is presently restricted by poor access to markets. There are plans for road development which will improve this situation.

Disadvantaged people
The most disadvantaged people in the district are the very small number in the Adelbert Range who have very low incomes and live in low potential environments. People in the upper Sogeram Valley earn very low incomes, while those in the lower Gogol Valley are constrained by moderate agricultural pressure. Overall, people in Madang District are slightly disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is moderate, access to services is good and cash incomes are moderate.
Middle Ramu District covers the upper Yuat Valley, the Schrader Range, the extensive floodplains of the lower Ramu Valley, the hills and floodplains of the Sogeram Valley and part of the Adelbert Range. Average annual rainfall ranges between 2400 and 4500 mm, with most of the district receiving over 3000 millimetres. Altitude varies from 40 m on the Ramu floodplain, to over 2800 m on Mt Aiome.

**Population**

The estimated rural population in the year 2000 is 41,000. Areas around Dusin, on the southern side of the Schrader Range, have moderate population densities of 38 persons/km$^2$. The northern side of the Schrader Range and lower Sogeram Valley have scattered populations with average densities of 14 persons/km$^2$. The middle Ramu and Sogeram valleys are very sparsely populated with 7 persons/km$^2$. The area around Aiome has significant in-migration of people from the surrounding mountains. The population in the Aiome-Angua-Anor census division increased by 8.3 per cent per year between 1980 and 1990. Areas west of Simbai, in the Schrader Range, have significant out-migration. The population in the Kaironk and Western Schraders census divisions decreased by an average of three per cent per year between 1980 and 1990.

**Access to services**

People on the southern side of the Schrader Range are very remote and require over one day’s travel to reach the nearest service centre, while those in the remainder of the district require up to eight hours’ travel. Outboard motor powered canoes are used to travel along the Ramu River. There is a road from Bogia to Josephpataal and there are plans to link this road back towards Madang through the Sogeram Valley, where there are logging roads at present. A road to the Ramu nickel mine near Aiome is under construction.

**Income**

Incomes in the district are very low to low, with minor sales of fresh food, betel nut and cocoa around Josephpataal, and coffee at higher altitudes around Dusin. Some people receive moderate incomes from wages and royalties associated with the Ramu nickel mine and logging operations in the Sogeram Valley.

**Subsistence agriculture and nutrition**

Agriculture in the Schrader and Adelbert ranges is characterised by low intensity sweet potato cultivation. Sago is the most important food in the Ramu and lower Sogeram valleys, supplemented by low intensity mixed staple gardens. Around Josephpataal, people cultivate low intensity taro and yam gardens. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as very serious; 55 per cent of children were stunted and 16 per cent were seriously under weight.

**Land potential**

The land potential in parts of the Sogeram and Ramu valleys is moderate, but soils are poor and rainfall is high. The hills around Josephpataal have low potential due to poor soils, steep slopes and high rainfall. Much of the Ramu Valley has very low to potential because of high rainfall, poor soils and frequent flooding. The Schrader Range has very low to potential caused by high rainfall, steep slopes, frequent cloud cover and low temperatures at higher altitudes. The valleys of the Yuat River and its tributaries have moderate potential but are very isolated.

**Agricultural pressure and potential**

There is no agricultural pressure in the district. The Sogeram Valley has potential for agricultural development, but has poor access to markets at present. There are plans for road development which will improve this situation. Fresh food and betel nut production are established smallholder cash-earning activities. Cocoa is a good option for development in the lower rainfall and lower altitude areas.

**Disadvantaged people**

The most disadvantaged people in the district are those in the Schrader Range where small numbers of people occupy low potential environments, earn very low incomes and have poor access to services. Large numbers of people in the Ramu Valley and Adelbert Range live in low potential environments and earn very low incomes. People in the Sogeram Valley earn very low incomes, while those around Josephpataal live in low potential environments. Overall, people in Middle Ramu District are extremely disadvantaged relative to people in other districts of PNG. There is no agricultural pressure, land potential is low, access to services is poor and cash incomes are very low. Child malnutrition is of serious concern.

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**Middle Ramu District**

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**Madang Province**

200
Rai Coast District covers Long Island, the Rai Coast, and the Finisterre Range. Long Island is an active volcano which is thought to have erupted catastrophically about 350 years ago. Average annual rainfall ranges between 2000 and 3400 mm, and increases from east to west. There is a long dry season in the east of the district. Altitude varies from sea level to over 3800 m at the top of the Finisterre Range. Agriculture is practised up to 2600 m near Teptep.

**Population**
The estimated rural population in the year 2000 is 44,000. The high valleys on the northern side of the Finisterre Range around Teptep, Gwarawon and Tairkram have population densities that average 50 persons/km². The Rai Coast and Long Island have average densities of 25 persons/km², while the valleys on the southern side of the Finisterre Range have 18 persons/km².

**Access to services**
People on the Rai Coast require around four hours’ travel to reach Madang town, while those in the Finisterre Range require up to eight hours’ travel. During the wet season, travel times from the Rai Coast to Madang rise significantly because of flooded unbridged rivers. Long Island is 70 km from Sidor and 130 km from Madang. It is the most remote part of the district as small boat travel is expensive and dangerous from December to March. People in the Finisterre Range are very remote and must walk to roads on the Rai Coast and in the Ramu Valley.

**Income**
Incomes are very low in most of the district and are derived from minor sales of betel nut, cocoa and copra. Incomes are low on Long Island. Some coffee and tobacco is sold in the Teptep and Gwarawon areas.

**Subsistence agriculture and nutrition**
Agriculture on the Rai Coast is dominated by low intensity mixed crop cultivation. Chinese taro, banana, coconut, taro and yam are important crops. One planting is made before a fallow period of 5–15 years. People in the northern valleys of the Finisterre Range cultivate low intensity sweet potato gardens; while those around Teptep make moderate intensity sweet potato gardens in which composting, village and ridging are used to maintain production. People in the southern valleys of the Finisterre Range cultivate low intensity banana and sweet potato gardens; while those living on Long Island make low intensity taro and yam gardens. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as serious; 62 per cent of children were stunted and five per cent were seriously under weight.

**Land potential**
The land potential on the coastal plains of Long Island is high in many areas, but is restricted by a long dry season and an active volcano. The Rai Coast has low to moderate potential due to poor soils, a long dry season and seasonal flooding. The lower valleys of the Finisterre Range, on both the northern and southern sides of the range, have low potential, while the upper valleys and slopes have very low potential. Common constraints are steep slopes, frequent cloud cover, low temperatures and poor soils.

**Agricultural pressure and potential**
The area around Teptep has strong agricultural pressure as a result of moderate intensity agriculture being practised in a very low potential environment. There are some opportunities for agricultural development along the Rai Coast.

**Disadvantaged people**
The most disadvantaged people in the district are those around Teptep where small numbers of people experience strong agricultural pressure and earn very low incomes. People are vulnerable to the effects of land degradation, declining crop yields, frost and food shortages, and have limited cash to purchase supplementary food. Large numbers of people in the northern valleys of the Finisterre Range are constrained by low potential environments and very low incomes. People in the southern valleys of the Finisterre Range occupy very low potential environments. Overall, people in Rai Coast District are extremely disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is low, access to services is moderate and cash incomes are very low. Child malnutrition is of concern.

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**Sumkar District** covers Karkar Island, Bagabag Island, the mountains and hills of the Adelbert Range, the limestone plains along the coast and the floodplains of the Malas, Gilgil and Surumurang rivers. Average annual rainfall ranges between 3000 and 3500 millimetres. Altitude varies from sea level to over 1200 m at the top of the Adelbert Range. People live as high as 800 metres.

**Population**
The estimated rural population in the year 2000 is 38,000. Most people live on Karkar Island where the population density is 110 persons/km². The coastal plains have high densities of 68 persons/km². The coastal hills have an average density of 14 persons/km², while the higher mountains are sparsely populated with 4 persons/km². The coastal plains have significant in-migration. The population in the Megiar census division increased by 5.4 per cent per year between 1980 and 1990.

**Access to services**
People on the coastal plains require less than one hour’s travel to Madang, while those in the coastal hills are within four hours’ travel. People on Karkar Island require around half a day’s travel to reach Madang by boat, while those in the Adelbert Range require up to eight hours’ travel. The north coast road runs through the district and connects with numerous branch roads which run into the coastal hills. Karkar Island has a good internal road network and is linked to the mainland by regular passenger boats.

**Income**
Incomes are high on Karkar Island and the coastal plains, and are derived from the sale of cocoa, copra, betel nut and fresh food. Incomes are moderate in the coastal hills and very low in the Adelbert Range.

**Subsistence agriculture and nutrition**
Agriculture on the coastal plains is dominated by moderate intensity taro and yam cultivation. There are two consecutive plantings before a fallow period of 1–4 years. People in the coastal hills make low intensity Chinese taro and taro gardens. Those in the Adelbert Range cultivate low intensity sweet potato and taro gardens. On Karkar Island, people make low intensity mixed staple gardens, but smallholder plantations of coconut and cocoa are extensive. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as serious; 53 per cent of children were stunted and eight per cent were seriously under weight.

**Land potential**
The land potential on Karkar Island is very high. Rainfall, slope, temperature, soils and light are ideal for the production of many crops, but the island is an active volcano. The coastal hills have high potential, but slopes are steep. The coastal plains have moderate potential that could be improved through better management of drainage and soil fertility. The Adelbert Range has low to moderate potential as a result of steep slopes, frequent cloud cover and poor soils.

**Agricultural pressure and potential**
There is moderate agricultural pressure on parts of the coastal plains as a result of intensive agriculture being practised in moderate potential environments. The future development of Karkar Island may be limited given that most land is already used for smallholder and plantation cocoa and copra production. The best opportunities for agricultural development are in the coastal hills and plains, where there is moderate to high land potential and good access to markets. Smallholder cocoa production has potential for development given that the cocoa industry is already established in the province and is supported by research and extension activities. Fresh food and betel nut production are also established smallholder cash-earning activities in these areas.

**Disadvantaged people**
The most disadvantaged people in the district are those in the Adelbert Range where small numbers of people are constrained by very low incomes and low potential environments. People on the coastal plains are affected by moderate agricultural pressure, while those in the coastal hills earn very low incomes. Overall, people in Sumkar District are slightly disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is very high, access to services is moderate and cash incomes are high. Child malnutrition is of concern.
Usino-Bundi District is one of the more diverse districts in PNG. It covers the rugged mountains of the Bismarck Fall including the remote Simbai Valley, the extensive floodplains of the Ramu Valley and the hills and floodplains of the Sogera Valley. Average annual rainfall ranges between 2200 and 4500 mm, with most of the district receiving over 3500 millimetres. Altitude varies from 100 m on the Ramu floodplain, to over 4000 m on the upper slopes of Mt Wilhelm. Agriculture is practised as high as 2200 metres.

Population
The estimated rural population in the year 2000 is 48,000. Areas around Simbai and Bundi have moderate population densities of 38 persons/km². Much of the Bismarck Fall is unoccupied apart from isolated villages, with densities of 7 persons/km². The Ramu and Sogera valleys are also sparsely populated with 7 persons/km². The upper Simbai Valley and upper Ramu Valley around Bundi, Brahman and Waihun have significant out-migration. Populations in the Mareng, Bundi and Uringa-Kesawai census divisions decreased by an average of five per cent per year between 1980 and 1990.

Access to services
Most people in the Bismarck Fall, the middle Ramu Valley and the Sogera Valley require up to eight hours' travel to reach the nearest service centre. Outboard motor powered canoes are used to travel along the Ramu River to the Brahmin Bridge. This bridge links the Ramu Highway to Bundi. Areas in the southeast around Usino and Dumpu are up to four hours' travel from Madang town along the Ramu Highway. Present road developments to the Ramu nickel mine near Assome and the Sogera forestry operations may improve access to areas on the northern side of the Ramu River.

Income
A small number of people in the villages associated with the Ramu Sugar estates have very high incomes derived from wage employment on the estates. Those living near the Ramu Highway earn moderate incomes from sales of betel nut, fresh food and other products. People in the remainder of the district earn very low incomes from minor sales of betel nut and fresh food. The Sogera forestry operations and the Ramu nickel mine provide wage employment and royalties to a small number of people.

Subsistence agriculture and nutrition
Agriculture in most of the district is characterised by low intensity sweet potato and taro cultivation. Casuarina trees are planted in fallows in the Simbai Valley to maintain soil fertility. On the Ramu floodplain, sago is the most important food, supplemented by low intensity mixed staple gardens. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as serious; 73 per cent of children were stunted and five per cent were seriously under weight.

Land potential
The land potential in the Sogera and upper Ramu valleys is moderate and is constrained by high rainfall and frequent flooding. Areas around Dumpu have less rainfall and a longer dry season. The Bismarck Fall has very low to low potential because of steep slopes, high rainfall, poor soils, frequent cloud cover and low temperatures at higher altitudes. The middle Ramu Valley has low potential due to high rainfall and frequent flooding.

Agricultural pressure and potential
There is no agricultural pressure in the district. The Sogera Valley has potential for agricultural development but is constrained by poor access to markets. There are plans for road development which will improve this situation. Fresh food and betel nut production are established smallholder cash-earning activities in this area.

Disadvantaged people
The most disadvantaged people in the district are those to the east of Simbai and around Bundi who are constrained by very low incomes and low potential environments. There are similar constraints in the middle Ramu Valley, but fewer people are affected. People in the Sogera Valley earn very low incomes. Overall, people in Usino-Bundi District are extremely disadvantaged relative to people in other districts of PNG. There is no agricultural pressure, land potential is low, access to services is poor and cash incomes are very low. Child malnutrition is of concern.
Betel nut and fresh food are transported to markets at Angoram along the Yaut River. Rafts, canoes and outboard motor boats are common forms of transport along the Sepik River and its tributaries. Produce such as betel nut, fresh food and fish is transported along the river system from remote villages to road heads at Pagwi and Angoram. People return to their villages with cash, purchased food and household goods.

Women sell fish and fresh food at the Maprik market. A diverse range of goods and produce, including fish from the Sepik River, are sold at markets in the inland hills around Maprik. Many people along the river trade fish and sago in return for garden produce and trade store goods. The Maprik market is an important economic centre for people in the inland hills, including those from nearby Sandaun Province.

East Sepik Province
Introduction

East Sepik occupies 43,700 km² in the northwest of PNG. The northern part of the province is dominated by the Wewak coastal plains and islands, the Torricelli Range and the Prince Alexander Range. South of these mountains is a large area of hill country that stretches from Dreikikir in the west, to Angoram in the east. The middle of the province covers the plains, floodplains, swamps and lakes of the Sepik River and its tributaries. The Sepik Valley is around 80 km wide and 320 km long. The level of the Sepik River rises and falls by up to five meters every wet season. South of the Sepik Valley are the rugged mountains of the Central Range, which extend into Enga Province. The east of the province consists of the mouth of the Sepik River and large areas of coastal swamp around the Murik Lakes. Altitude varies from sea level to over 3000 m on the Central Range. The highest place where agriculture is practised is near Dreikikir, at 800 metres. Average annual rainfall varies from 1800 mm near Maprik, to over 4000 mm near April River. There is a moderate to long dry season in the east of the province with the driest area being in the lower Sepik Valley around Angoram. The six districts in East Sepik are Ambunti-Dreikikir, Angoram, Maprik, Wewak, Wosera-Gaui, and Yangoru-Sausia.
The estimated rural population of East Sepik in the year 2000 is 270,000, which is seven per cent of the national rural population. The provincial rural population growth rate is 1.6 per cent per annum. Large East Sepik migrant communities are found at Rabaul, Madang, Lae and in the West New Britain oil palm settlements. The highest out-migration is from the Sepik Valley around Ambunti. The highest population densities are south of Maprik, in the Amogu Valley, with 175 persons/km². The Maprik area has densities that average 80 persons/km², while the Yangoru area and the islands off the Wewak Coast have 60 persons/km². The area around Dreikikir and remote villages in the east of the province have densities of 30 persons/km², while the Wewak Coast and Sepik Valley have 15 persons/km². The northern fall of the Central Range has very low densities of one person/km².
The Sepik Highway runs from Wewak to Maprik and is a well designed road, but is poorly maintained. It runs through the areas which have the highest population densities in the province. Traffic from inland Sandaun Province also traverses this road en route to Wewak. Roads from Pagwi and Angoram connect the Sepik River to the highway. There is a good road along the coast from Wewak to Attape in Sandaun Province, but many river crossings are not bridged and flash floods are common. Outboard motor boat and canoe travel are common along the Sepik River and between the coast and islands. People in the hills, between Drekikir and Yangorou, and on the coast and islands around Wewak, live within four hours’ travel of Maprik or Wewak. Most other people in the province require 4–8 hours’ travel to reach the nearest service centre, except for those in the northern fall of the Central Range and in remote parts of the Sepik Valley, who must travel for more than one day.
Average incomes in East Sepik are relatively low. People in the Gavien Resettlement Scheme, north of Angoram, earn high incomes from the sale of rubber, cocoa, betel nut and fresh food. People around Dreilikir, Maprik and Yangoru earn moderate incomes from the sale of cocoa, Robusta coffee and fresh food. Those in the Sepik Valley and on the Wewak Coast earn low incomes from minor sales of fresh food, cocoa, fish and betel nut. People in the northern fall of the Central Range and in remote areas of the Sepik Valley have very low incomes. Cocoa is an expanding smallholder cash-earning activity in the province, particularly west of Maprik where most villages have at least one fermentary. However, the marketing of cocoa is constrained by poor road maintenance. There are large fresh food and fish markets at Pagwi, Angoram, Maprik and Wewak. Despite a large migrant population outside the province, little money is remitted back to rural villages. There are no large-scale resource extraction industries in the province.
Agriculture in the inland hills, between Dreikikir and Yangoru, is characterised by low intensity mixed staple production of yam, taro and banana. Sago and coconut are also important foods. In general, there are two consecutive plantings before fallow periods of around 15 years, but a third planting of sweet potato is becoming increasingly common. Soil retention barriers are used on slopes, and drains are used on flatter land. There are small areas of high intensity yam cultivation on the floodplains of the Amogu, Parchi and Nana rivers. Production is maintained through the use of land improvement practices such as drainage and mounding. Sago is the most important food in the rest of the province, supported by low intensity mixed staple production of taro, yam, banana, sweet potato and Chinese taro.
The land potential is high to very high in the inland hills, from Dreikikir to Angoram, but is constrained in places by steep slopes and poor soils. Management practices such as soil retention barriers, drainage and mounding are used to improve land potential. The Wewak coast, Kairi River, Muschu Island and the Prince Alexander Range have moderate potential limited by steep slopes. The northern tributaries of the Sepik River have low to moderate potential caused by frequent flooding, while the Sepik Valley has low potential constrained by seasonal inundation, poor soils and high rainfall in the west. The northern fall of the Central Range has very low to low potential due to steep slopes, poor soils, high rainfall and frequent cloud cover.
There are small areas of marginal agricultural pressure in the foothills around Nangumaru and on the floodplain of the Atilem River. There is potential for agricultural development in the foothills, from Dreikikir to Angoram, due to the high to very high land potential and good access to markets. Poor maintenance of the Sepik Highway and branch roads is a major constraint to development in the area. There is potential for expansion of the smallholder cocoa industry in the inland hills, given the active research and extension activities in the province and the suitability of the recently developed solar dryers to the local climate. The production of Robusta coffee is generally constrained by poor prices. Vanilla production is in an early stage of development and further expansion will depend on adequate marketing arrangements and price. Fresh food and betel nut are also established smallholder cash-earning activities.
The most disadvantaged people in the province are the small populations in the northern fall of the Central Range and the fringe areas of the Sepik Valley around April River, Maposi, Frieda River, Hotmin, May River, Ama and Iteri. People in these areas earn very low incomes, have poor access to services and live in low potential environments. They have limited opportunities to improve their livelihoods. People around Bunam and Marukon, on the plains of the Karam River, earn very low incomes and live in low potential environments. Large numbers of people living on the Kairiru, Muschu, Walis, Yuo, Kerereal and Tarawai islands and in the lower Torricelli foothills earn very low incomes. Large numbers of people in the Sepik Valley live in a low potential environment.

### Disadvantaged people

![Disadvantaged people chart]

- Poor environment, very low income, poor access
- Very low income, poor access
- Poor environment, very low income
- Strong pressure
- Poor environment
- Very low income
- Not disadvantaged (relative to other areas)
- Unoccupied land
- Lake

District boundaries

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**Ambunti-Dreikikir District** is in the west of the province. It extends from the foothills of the Torricelli Range, around Dreikikir, to Ambunti on the Sepik River. Average annual rainfall ranges from 1900 mm in the inland hills, to over 4000 mm in the upper Sepik Valley. Altitude varies from 30 m in the Sepik Valley, to over 1000 m on the Torricelli Range.

**Population**
The estimated rural population in the year 2000 is 48,000. Most people in the district live around Dreikikir and southwest of Maprik where there are average population densities of 50 persons/km$^2$. The Ambunti area and the southern tributaries of the Sepik River have densities of 14 persons/km$^2$. The Sepik Valley itself has very low densities of 4 persons/km$^2$.

**Access to services**
There is no road connection between the district headquarters at Ambunti and the most populous parts of the district around Dreikikir. It is faster and easier for people in the foothills to reach the provincial capital at Wewak than to travel to Ambunti. People along the Sepik River require 4–8 hours’ travel to reach Wewak. Those living along the southern Sepik tributaries are very remote and require more than one day’s travel to reach the nearest service centre. The Sepik Highway runs through the north of the district from Maprik to Dreikikir and on to Lumi, but it is poorly maintained and often impassable after extended periods of wet weather. Outboard motor boats and canoes are used along the Sepik River.

**Income**
Incomes are moderate in the foothills around Dreikikir and are derived from the sale of cocoa, Robusta coffee and fresh food. People in the remainder of the district have very low to low incomes. Minor sales of cocoa and Robusta coffee provide income to people in the lower hills, while fresh and smoked fish, betel nut and cocoa are the main sources of income in the Sepik Valley.

**Subsistence agriculture and nutrition**
Agriculture in the Torricelli foothills is characterised by low intensity yam cultivation, with taro and banana as other important staple crops. Coconut and sago are also important foods. There are two consecutive plantings before fallow periods of 15–25 years, but a third planting of sweet potato is becoming common. Land improvement practices include composting with Pometia leaves and the use of soil retention barriers. Sago is the most important food in the Torricelli Range, on the lower hills and in the Sepik Valley. It is supplemented by low intensity mixed staple cultivation of banana, taro and sweet potato. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as serious; 73 per cent of children were stunted and eight per cent were seriously under weight.

**Land potential**
The land potential in the foothills around Dreikikir is high to very high, but is constrained in places by steep slopes. Soil retention barriers and mounding improve the land potential. The Torricelli Range and its lower hills have high potential limited by poor soils. Isolated areas on flood-free land around Ambunti have high potential constrained by poor soils. The plains of the Yimmi and Amogu rivers have moderate potential caused by poor soils and frequent flooding, while the Sepik Valley has low potential due to poor soils, frequent flooding and high rainfall in the west.

**Agricultural pressure and potential**
There is little agricultural pressure in the district. There is potential for agricultural development in the Torricelli foothills given the high to very high land potential and reasonable access to markets. Cocoa, fresh food and betel nut are established smallholder cash-earning activities. Robusta coffee has also been produced for a long time, but prices are low compared to other cash crops.

**Disadvantaged people**
The most disadvantaged people in the district are the small populations in the fringe areas of the Sepik Valley, upstream of Ambunti, in places such as Maposi, Ama, Hotmin, Iteri and Frieda River. These people have poor access to services, earn very low incomes and live in low potential environments. They have few opportunities to improve their livelihoods. People in the lower hills south of Dreikikir, around Masalaga, Bongiwanai and Nungwaia, earn very low incomes, while those along the Sepik River live in a low potential environment. Overall, people in Ambunti-Dreikikir District are moderately disadvantaged relative to people in other districts of PNG. There is no agricultural pressure, land potential is high, access to services is moderate and cash incomes are low. Child malnutrition is of concern.
Angoram District covers the Marienberg Hills, the Murik Lakes, the plains and swamps of the lower Sepik Valley, the Sepik Coast and the mountainous northern fall of the Central Range. Average annual rainfall ranges from 1800 mm in the Marienberg Hills, to over 4000 mm in the Central Range. The eastern half of the district has a moderate to long dry season. Altitude varies from sea level to over 3000 m on the Central Range.

Population
The estimated rural population in the year 2000 is approximately 51,000. The highest population density is in the Gavien Resettlement Scheme, north of Angoram, with 53 persons/km². The plains of the Keram River, in the east of the district, have 25 persons/km². The lower Sepik Valley has 14 persons/km², while the northern fall of the Central Range and the Sepik Coast have very low densities of one person/km². The Sepik Valley and the northern fall of the Central Range are largely unoccupied.

Access to services
People in the Gavien Resettlement Scheme and around Angoram are within four hours’ travel of the nearest service centre, but those in the Sepik Valley and on the Sepik Coast require 4–8 hours’ travel. The northern fall of the Central Range is very remote and people require more than one day’s travel to reach the nearest service centre. There is a good road from Wewak to Angoram, which is partly sealed. Outboard motor boats and canoes are used on the Sepik and Keram rivers.

Income
Incomes are high in the Gavien Resettlement Scheme and are derived from the sale of cocoa, betel nut, rubber and fresh food. People along the Sepik and Keram rivers earn moderate incomes from the sale of betel nut, fish and cocoa. Those on the Sepik Coast earn low incomes from the sale of fish. In the Marienberg Hills and on the plains of the Sepik Valley, people earn low incomes from minor sales of fresh food and cocoa, while those on the plains of the Keram River and on the northern fall of the Central Range have very low incomes.

Subsistence agriculture and nutrition
Sago is the most important food in the district and is supplemented by low intensity mixed staple cultivation of banana, taro and Chinese taro. There is one planting before fallow periods of 5–15 years. Coconut is also an important food. People along the Sepik and Keram rivers and on the Sepik Coast have only small gardens and exchange fish for sago and coconut, while those around the Murik Lakes live by fishing and trading alone. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as poor; 41 per cent of children were stunted and seven per cent were seriously under weight.

Land potential
The land potential in the Marienberg Hills is high with no constraints. The Sepik Valley, Sepik Coast and plains of the Keram River have low potential constrained by poor soils and long-term inundation. The northern fall of the Central Range has very low to low potential caused by steep slopes, poor soils, high rainfall and frequent cloud cover.

Agricultural pressure and potential
There is no agricultural pressure in the district. There is potential for agricultural development in the Marienberg Hills given the high potential land and reasonable access to markets. Cocoa, fresh food and betel nut are established smallholder cash-earning activities. Robusta coffee is also well established, but prices are low compared to other cash crops.

Disadvantaged people
The most disadvantaged people in the district are those on the plains of the Keram River who are constrained by very low cash incomes and low potential environments. These people have few opportunities to improve their livelihoods. Large numbers of people in the Sepik Valley live in a low potential environment. Overall, people in Angoram District are seriously disadvantaged relative to people in other districts of PNG. There is no agricultural pressure, land potential is low, access to services is moderate and cash incomes are low.
Maprik District is located on the southern side of the Torricelli Range and covers the foothills around Maprik, the valleys of the Ambuk and upper Amogu rivers, and the floodplains and plains of the Parchee River and its tributaries. Average annual rainfall ranges from 1800 mm on the inland hills, to 2100 mm in the Parchee Valley. Altitude varies from 50 m in the lower Parchee Valley, to over 1000 m on the Torricelli Range.

Population
The estimated rural population in the year 2000 is 53,000. The district is characterised by high population densities. Highest densities occur in the narrow Parchee Valley, south of Maprik, where there are 175 persons/km². The foothills around Maprik town have 92 persons/km², while the southern part of the district supports 60 persons/km². The Torricelli Range has low densities of 14 persons/km².

Access to services
Most people are within four hours’ travel of Maprik, a small but important market and service centre. People in the Torricelli Range require more than four hours’ travel to reach the nearest service centre. The Sepik Highway runs through the north of the district. A highway standard road connects Maprik with Pagwi on the Sepik River. A well-developed network of rural roads link villages in the Maprik area.

Income
In the Torricelli foothills around Maprik, moderate incomes are derived from the sale of cocoa, Robusta coffee and fresh food. People on the floodplains of the Parchee River earn very low incomes from minor sales of cocoa, fresh food and Robusta coffee. Small-scale alluvial gold mining occurs north of Maprik and provides some income to a small number of people.

Subsistence agriculture and nutrition
Agriculture in most parts of the district is characterised by low intensity yam cultivation. There are 2–3 consecutive plantings before a fallow period of around 15 years, and production is maintained by management practices such as soil retention barriers and mulching. South of Maprik, people cultivate low intensity banana and yam gardens, while those in the Parchee Valley make high intensity yam gardens. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as serious; 60 per cent of children were stunted and eight per cent were seriously under weight.

Land potential
The land potential in the Torricelli foothills around Maprik, and in the upper Amogu Valley is high to very high with suitable soils and minor seasonal flooding. The floodplains of the Parchee River and its tributaries have high potential constrained by seasonal flooding, while the surrounding plains have low to moderate potential limited by poor soils and seasonal flooding. The Torricelli Range has low to moderate potential caused by steep slopes and frequent cloud cover.

Agricultural pressure and potential
According to the measures used in this handbook, there is little agricultural pressure in the district. However, tall woody fallow vegetation is giving way to tall grass and scrub in the area around Maprik, which suggests that land degradation is occurring. There is potential for agricultural development in the hills north and west of Maprik, and in the upper Amogu Valley, given the high to very high land potential and reasonable access to markets. However, land shortages caused by very high population densities around Maprik may be a constraint. Cocoa, fresh food and betel nut are established smallholder cash-earning activities in these areas. Robusta coffee is also well established, but prices are low compared to other cash crops.

Disadvantaged people
The most disadvantaged people in the district are those on the floodplains of the Parchee River and along its tributaries. Here, incomes are very low, population densities are very high and land is scarce, which restricts the planting of cocoa and coffee. Overall, people in Maprik District are slightly disadvantaged relative to people in other districts of PNG. There is some agricultural pressure on land, but this is being offset to some extent by continuing out-migration. Land potential is high, access to services is good and incomes are moderate. Child malnutrition is of concern.
**Wewak District** is located in the north of the province and covers the northern side of the Prince Alexander Range, the coastal plains and hills between the Sandaun border and Kaup, and the coastal islands. The inshore islands of Kairiru, Muschu, Walis, Yoo, Keresau and Tarawai are close to Wewak, while the Schouten Islands (Vaeko, Koiul, Wbi, Blup Blup, Blap, Kodava and Bam) are between 60 and 130 km from Wewak. Average annual rainfall ranges between 1800 and 2100 mm, with a moderate to long dry season in the east. Altitude varies from sea level to over 1200 m on the Prince Alexander Range.

**Population**

The estimated rural population in the year 2000 is 30,000. The highest population densities are on the Schouten Islands with 60 persons/km². The Prince Alexander Range and the coastal plains have densities of 14 persons/km². People from both East Sepik and Sandaun provinces migrate to the peri-urban areas of Wewak in search of better access to services and wage employment.

**Access to services**

People around Wewak and on the inshore islands are within four hours’ travel of Wewak. Those in the Prince Alexander Range, on the coastal plains and on the Schouten Islands require 4–8 hours’ travel to reach Wewak. There is a reasonable quality road along the coast to Aitape, but rivers are unbridged and the crossings are subject to flooding. Another road runs east from Wewak to Terebu. Outboard motor boat and canoe travel are common in the coastal areas.

**Income**

On the Schouten Islands, moderate incomes are derived from the sale of copra, fish and fresh food. People in the rest of the district earn very low to low incomes from minor sales of cocoa, fresh food and Robertsia coffee on the Prince Alexander Range; and cocoa, fish and fresh food on the coastal plains and inshore islands. There is wage employment in Wewak and remittances are sent back to families in rural areas. Wewak has a large and important market which is used by sellers from all parts of the province.

**Subsistence agriculture and nutrition**

Sago is the most important food in the district and is supplemented by low intensity mixed staple cultivation of taro, banana and Chinese tare. People on the Schouten Islands cultivate low intensity banana gardens with cassava, sweet potato, tare and yam as other important crops. Sago and coconut are also important foods. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as poor; 32 per cent of children were stunted and 10 per cent were seriously under weight.

**Land potential**

The land potential in the hills inland of Kaup is high with no constraints. The coastal plains and hills have moderate potential constrained by seasonal flooding or steep slopes, while the Prince Alexander Range has low to moderate potential limited by steep slopes and frequent cloud cover. The inshore islands have moderate potential caused by steep slopes and poor soils, while the Schouten Islands have moderate to high potential with similar constraints.

**Agricultural pressure and potential**

There is no agricultural pressure in the district. There is potential for agricultural development in the hills inland of Kaup given the high land potential and reasonable access to markets. The coastal plains and hills also have potential for agricultural development given the moderate land potential and good access to markets. Cocoa, fresh food and betel nut are established smallholder cash-earning activities in these areas.

**Disadvantaged people**

The most disadvantaged people in the district are those on Kairiru, Muschu, Walis, Yoo, Keresau and Tarawai islands who earn very low incomes. Overall, people in Wewak District are moderately disadvantaged relative to people in other districts in PNG. There is no agricultural pressure, land potential is moderate, access to services is good and cash incomes are low.
Woera-Gaui District
covers the Torricelli foothills around the Amogu and Nanu rivers south of Maprik, the plains and swamps of the Sepik Valley, the Hunstein Range, and the northern fall of the Central Range. Average annual rainfall ranges from 1900 mm in the inland hills, to over 4000 mm in the Central Range. Altitude varies from 20 m in the Sepik Valley, to over 3000 m on the Central Range.

Population
The estimated rural population in the year 2000 is 46,000. The highest population density is on the floodplain of the Amogu River with 175 persons/km². In the foothills to the west of the Amogu River, densities are 127 persons/km². The Sepik Valley has 14 persons/km², while the northern fall of the Central Range has very low densities of one person/km². The Sepik Valley and northern fall of the Central Range are largely unoccupied. There is significant out-migration from the Sepik Valley to Lae and Madang, and from the Woera area to Lae and Hoskins. If the Hoskins settlers return, serious land problems will occur.

Access to services
People in the Torricelli foothills live within four hours’ travel of the nearest service centre. Those in the Sepik Valley require 4–8 hours’ travel to reach the nearest service centre, while people in the northern fall of the Central Range are very remote and require more than one day’s travel. The Sepik Highway runs north of the district border, from Maprik to Dreikikir, and connects to a network of rural roads that cover most areas in the inland hills. There is a good road from Maprik to Pagwi, on the Sepik River. The river communities travel to Pagwi by canoe and boat, and on to Maprik and Wewak by road.

Income
On the floodplain of the Amogu River, moderate incomes are derived from the sale of cocoa, Robusta coffee and fresh food. People in the remainder of the district earn very low to low incomes from minor sales of cocoa and Robusta coffee in the hills, and betel nut, fish and cocoa in the Sepik Valley.

Subsistence agriculture and nutrition
Agriculture on the Amogu River floodplain is characterised by high intensity yam cultivation. There are 3–5 consecutive plantings before fallow periods of 1–4 years. Production is maintained through the use of drainage and mounding. People in the hills west of the Amogu River cultivate low intensity yam gardens. Sago is the most important food in the Sepik Valley and on the northern fall of the Central Range, supplemented by low intensity mixed staple or taro gardens. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as serious; 52 per cent of children were stunted and seven per cent were seriously under weight.

Land potential
The land potential in the Amogu Valley and nearby hills is high to very high with no constraints. The lower Amogu Valley has moderate potential constrained by poor soils and seasonal flooding, while the Sepik Valley has low potential limited by poor soils, long-term seasonal inundation and high rainfall in the south. The northern fall of the Central Range has very low to low potential due to steep slopes, poor soils, high rainfall and frequent cloud cover.

Agricultural pressure and potential
According to the measures used in this handbook, there is little agricultural pressure in the district. However, the presence of degraded fallow vegetation in the Woera hills indicates that there may some land degradation in the area. This, together with land shortages and very high population densities, are constraints to development. However, some potential exists for agricultural development in the Amogu Valley and nearby hills, given the high to very high land potential and reasonable access to markets. Cocoa, fresh food and betel nut are established smallholder cash-earning activities in this area. Robusta coffee is also well established, but prices are low compared to other cash crops.

Disadvantaged people
The most disadvantaged people in the district are the very small populations in the Korosameri, Salumei and April valleys, on the fringe of the Central Range, who have poor access to services, earn very low incomes and live in a low potential environment. These people have few opportunities to improve their livelihoods. Large numbers of people in the hills, west of the Amogu River, earn very low incomes. Overall, people in Woera-Gaui District are slightly disadvantaged relative to people in other districts of PNG. There is some agricultural pressure on land, but this is being offset by continuing high out-migration. Land potential is high, access to services is good and cash incomes are low. Child malnutrition is of concern.

Total area (km²): 9055
Occupied area (km²): 1337
Airstrips: 8
Major roads (km): 63
Minor roads (km): 0
Mountains & hills (%): 60
Fans & plains (%): 12
Floodplains & swamps (%): 28
Yangoru-Saussia District is located in the central north of the province, on the southern side of the Prince Alexander Range. It covers the foothills of the Prince Alexander Range, the Nagam Valley, and the floodplains and plains of the Atilem, Hambili, Paik, Mindjim, Nagam and Yemogu rivers, all of which flow into the Sepik River. Average annual rainfall ranges between 1800 and 2000 mm, with a moderate to long dry season in the east. Altitude varies from 30 m in the lower Atilem Valley, to over 1000 m on the Prince Alexander Range.

Population
The estimated rural population in the year 2000 is 42,000. The highest population densities occur around Yangoru and on the floodplains of the Atilem River with 60 persons/km². In the hills around Nangumaru, densities are 45 persons/km², while the Nagam Valley and floodplains of the Hambili, Paik, Mindjim, Nagam and Yemogu rivers have 14 persons/km². Much of the southern half of the district is unoccupied.

Access to services
People in the foothills of the Prince Alexander Range, between Yangoru and Nangumaru, and those on the floodplains of the Atilem River are within four hours’ travel of Wewak. People in the Nagam Valley and on the floodplains of the Hambili, Paik, Mindjim, Nagam and Yemogu rivers require 4–8 hours’ travel to reach Wewak. The Sepik Highway runs through the north of the district and connects to a network of roads that cover most inhabited areas. The highway is sealed from Wewak to near the eastern border of the district.

Income
In the foothills of the Prince Alexander Range, around Yangoru, moderate incomes are derived from the sale of cocoa and fresh food. People in the rest of the district earn very low to low incomes from minor sales of cocoa, fresh food and Robusta coffee.

Subsistence agriculture and nutrition
Agriculture in the foothills of the Prince Alexander Range and on the floodplains of the Atilem River is characterised by low intensity taro and yam cultivation. People typically make two consecutive plantings before fallow periods of 5–15 years. Production is supported by land improvement practices such as soil retention barriers. West of Yangoru, people cultivate low intensity banana and yam gardens. Sago is the main food in the Nagam Valley and on the floodplains of the Hambili, Paik, Mindjim, Nagam and Yemogu rivers and is supplemented by low intensity mixed staple gardens. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as poor; 40 per cent of children were stunted and six per cent were seriously under weight.

Land potential
The land potential in the foothills of the Prince Alexander Range, around Yangoru, is high to very high with no constraints. The remaining foothill areas and the Prince Alexander Range have moderate to high potential constrained by steep slopes. Soil retention barriers reduce soil erosion and increase land potential. The Nagam Valley and floodplains of the Hambili, Paik, Mindjim, Nagam and Yemogu rivers have moderate to high potential limited by poor soils, while the surrounding plains have low potential caused by poor soils.

Agricultural pressure and potential
There is marginal agricultural pressure in the foothills around Nangumaru and on the floodplain of the Atilem River. There is potential for agricultural development in the Prince Alexander foothills, between Yangoru and Muniwara, given the high to very high land potential and good access to markets. Cocoa, fresh food and betel nut are established smallholder cash-earning activities in the area. Robusta coffee is also well established, but prices are low compared to other cash crops.

Disadvantaged people
The most disadvantaged people in the district are those on the foothills of the Prince Alexander Range, around Yarabung and Nangumaru, who earn very low incomes. Overall, people in Yangoru-Saussia District are slightly disadvantaged relative to people in other districts of PNG. There is little agricultural pressure, land potential is high, access to services is good and cash incomes are low.
Sandaun Province

Landscape in the Tekin Basin with planted casuarina fallows. This image shows planted casuarina fallows, which maintain soil fertility in the Tekin Basin near Oksapmin. People in Telefomin District are amongst the most disadvantaged in the country. Environments have low potential for agriculture with numerous constraints, child malnutrition is serious, people earn very low incomes and many must travel for long distances to reach service centres. Other than some potential to sell fresh food to the Ok Tedi mining community in nearby Western Province, people have few opportunities to improve their livelihoods.

A four-wheel drive vehicle bogged on a poor quality road. While the coastal areas and inland hills of Sandaun Province have a good network of roads, poor road quality is a major constraint to development in other areas of the province. There are often limited funds for maintenance and some roads become impassable after extended periods of wet weather. Some roads in the province are constructed and maintained by logging companies and deteriorate once logging activities finish.
Sandaun occupies 36,000 km² in the northwest of PNG. The province runs from the northwest coast to the main divide of PNG and covers a diverse range of environments. Plains, floodplains, swamps and hills dominate the north coast. The northwest of the province includes the Oenake Range behind Vanimo, the plains of the Pwuri and Nemayer rivers, the Serra Hills and the Bewani Mountains. The northeast of the province includes the plains of the Arnold and Yalini rivers, the Torricelli Range and the southern Torricelli foothills. The centre of the province is dominated by the plains and floodplains of the Sepik Valley including the Sepik River itself and the Nambilo, Wagau, Nopan, Wagana, Yellow, North, Horden, Green and Yapsiei rivers. The Border Mountains lie along the border with the Indonesian province of Irian Jaya. The Telefomin area, in the south of the province, is remote and rugged and covers the headwaters of the Sepik River and mountains of the West, Thurnwald, Fiamulu, Star and Victor Emanuel ranges. Altitude varies from sea level to over 4000 m in the Star Mountains. Average annual rainfall varies from 2000 mm near Aitape, to over 4000 mm in the upper Sepik Valley near Yapsiei. There is a moderate dry season in the northeast of the province. The four districts in Sandaun are Aitape-Lumi, Nuku, Telefomin and Vanimo-Green River.
The estimated rural population of Sandaun in the year 2000 is 151,000, which is four per cent of the national rural population. The provincial rural population growth rate is 1.8 per cent per year. The highest population density is in the Tekin Basin, west of Oksapmin, where there are 98 persons/km². The area south of Telefomin and the coastal areas around Vanimo have an average density of 80 persons/km². The Aitape coastal plains, Torricelli foothills and Oksapmin area have moderate densities of 23 persons/km², while the remaining areas in the province have low densities of 10 persons/km². Approximately half of the province is unoccupied. There is significant in-migration into the Torricelli foothills, while the Ok Om Valley, north of Oksapmin, has significant out-migration.
The Sepik Highway connects Lumi, Nuku and other areas in the Torricelli foothills to Maprik and Wewak in East Sepik Province, but not to the provincial headquarters at Vanimo. Aitape is also connected to Wewak, but not Vanimo, via the Coastal Highway. There is a good road that runs from Vanimo along the coast to the border with Irian Jaya and continues on to Jayapura. There is also a road of lesser quality that runs inland from Vanimo to Beweni. A road network from logging operations is developing in the Nemayer plains and Serra Hills to the east of Vanimo. A road from Aitape through the Torricelli Range to Lumi is almost complete but progress on the final section is sporadic. There are no roads to Telefonin or Oksapmin, in the southern mountains, and these areas are only accessible by expensive air travel. Most people on the Vanimo Coast can travel to Vanimo in under one hour. Those in the Torricelli foothills, the Aitape Coast, Border Mountains, Beweni Range, Nemayer plains and Serra Hills require 4–8 hours’ travel to reach the nearest service centre. Most other people in the province are very remote and require more than one day’s travel.
Rural people in Sandaun are the poorest in PNG. People around Vanimo earn low incomes from sales of fresh food and betel nut. People around Oksapmin and Telefomin earn low incomes from sales of fresh food to the Ok Tedi mine in Western Province. Many people in the Telefomin area also receive remittances from relatives who are working at the mine. People in the Torricelli foothills have very low incomes which are derived from minor sales of cocoa and Robusta coffee. Smallholder cocoa production is increasing around Lumi but regular purchasing is prevented by poor road conditions and occasional periods of criminal activity along the Sepik Highway. All other people in the province are very poor and derive very low incomes from sales of fresh food, rubber or fish. Some income is derived from wage employment and royalties provided by forestry operations near Vanimo and Aitape.

![Income Chart]

<table>
<thead>
<tr>
<th>Number of People</th>
<th>Aitape-Lumi</th>
<th>Nuku</th>
<th>Telefomin</th>
<th>Vanimo-Green River</th>
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<tbody>
<tr>
<td>Unoccupied land</td>
<td>District boundaries</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Income categories:
- Very low income (0–20 kina/person/year)
- Low income (21–40 kina/person/year)
- Moderate income (41–100 kina/person/year)
- High income (101–200 kina/person/year)
- Very high income (> 200 kina/person/year)
Sago is the most important food in the lowlands of the province and is supplemented by low intensity mixed staple cultivation. There is one planting before a fallow period of more than 15 years. On the coastal plains around Vanimo, people cultivate low intensity mixed staple gardens. Here, coconut is an important food. People in the southern mountains cultivate low intensity taro gardens, while those around Okaipepin make low intensity sweet potato gardens. Land management practices that improve productivity are not widely used in the province.
The land potential is high to very high in the Torricelli foothills, Bewani foothills and Oenake Range, where there are few limitations. The Torricelli Range has low to moderate potential due to steep slopes and frequent cloud cover. The coastal plains have moderate to high potential limited by poor soils and frequent flooding. The Serra Hills and Border Mountains have high potential constrained by steep slopes, while the Sepik Valley has low potential due to poor soils, high rainfall and frequent inundation. The southern mountains have low potential caused by steep slopes, high rainfall and frequent cloud cover, while the Tekin, Ok Om and Strickland valleys have very low to moderate potential constrained by steep slopes, frequent cloud and high rainfall.

Papua New Guinea Rural Development Handbook — Sandaun Province
There is no agricultural pressure on land in the province. There is potential for agricultural development in the Torricelli foothills given the high to very high land potential and reasonable access to markets in Wewak. Further road development through the Torricelli foothills, regular road maintenance along the Sepik Highway and new roads from Lumi to Aitape are necessary to realise the full potential of the area. There is also some potential for agricultural development on the Oenake Range and in the Serra Hills given the high land potential and reasonable access to Vanimo, which may improve if planned road developments take place. The Bewani foothills and Border Mountains have moderate to high land potential but there is poor access to markets. There is potential for expansion of the smallholder cocoa industry in the province, given the active extension activities and the recent development of solar driers. Fresh food and betel nut are also established smallholder cash-earning activities.
Most people in Sandaun are strongly disadvantaged relative to people in other districts of PNG. The most disadvantaged people in the province live in the southern mountains in places such as Telefomin, Mianmin, Tumolbil and Yapisiei. In these areas, large numbers of people are constrained by low potential environments, very low incomes and poor access to services. They have few opportunities to improve their livelihoods. Smaller numbers of people in the Sepik Valley around Idam, Green River, Kwonmtari, Guriaio, Yellow River, Yiluz and Wokiem have similar problems. People in the Olksapmin area earn very low incomes and live in a low potential environment. Most other people in the province earn very low incomes.
Sandaun Province

Aitape-Lumi District

is in the north of Sandaun and covers parts of the Sepik Valley, Torricelli foothills, Torricelli Ranges and coastal plains and hills. The coastal plains and hills extend from Sissano in the west to the border with East Sepik Province. The coastal plains are dissected by the floodplains of the Arnold, Yalingi, Rainu, Nigla, Harech and Danop rivers. Average annual rainfall ranges between 2000 and 2700 mm, increasing from east to west. Altitude varies from sea level to over 1500 m on the Torricelli Range.

Population

The estimated rural population in the year 2000 is 39,000. The population density in the Torricelli foothills and coastal plains is 23 persons/km², while the far south of the district has only 3 persons/km². The area around Lumi has significant in-migration, with the population of the Somoro census division increasing by five per cent per year between 1980 and 1990.

Access to services

The Sepik Highway connects Lumi and other areas in the Torricelli foothills to Maprik and Wewak, but not to the provincial headquarters at Vanimo.

The Sepik Highway is poorly maintained and often closed between Lumi and Maprik after extended rainfall. Periodic criminal activity between Maprik and Wewak also inhibits travel. A road along the coast connects Aitape to Wewak, but it is often closed by flooded river crossings. A road from Aitape to Lumi is almost complete but work on it has ceased. A plan exists to connect Aitape to Vanimo through the Serra Hills. Aitape Harbour is not protected from the northwest winds and swell during the wet season. People in the Torricelli foothills and coastal plains require 4–8 hours’ travel to reach the nearest service centre, while those in the far south are very remote and require more than one day’s travel.

Income

Incomes are very low in the entire district and are derived from minor sales of cocoa, Robusta coffee and fresh food. Cocoa production is increasing in the Torricelli foothills. Small numbers of people receive wages and royalties from the Damansara forestry and oil palm project which is inland of Aitape.

Subsistence agriculture and nutrition

Sago is the most important food in the district. Coconut is also an important food. People in most areas cultivate supplementary low-intensity mixed-staple gardens, with one planting followed by a fallow period of more than 15 years. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as poor; 35 per cent of children were stunted and 10 per cent were seriously underweight.

Land potential

The land potential in the Torricelli foothills around Lumi is high, but is limited by steep slopes in some places. The plains and hills inland of Aitape have high land potential limited by seasonal flooding in low-lying areas. The eastern extent of the Serra Hills has high potential constrained by steep slopes, while the coastal plains and floodplains have low to moderate potential caused by poor soils and seasonal flooding.

Agricultural pressure and potential

There is no agricultural pressure in the district. There is potential for agricultural development in the Torricelli foothills given the high land potential and reasonable access to markets. Further road development through the Torricelli foothills, regular road maintenance along the Sepik Highway and the new road from Lumi to Aitape are necessary to realise the full potential of the area. Cocoa production is a developing smallholder cash-earning activity and Robusta coffee is well established, but prices for the latter are low compared to other cash crops. The high potential land south of Aitape is the site of the Damansara forestry and oil palm project. Other areas around Aitape have potential for agricultural development given the moderate to high potential land and access to the ports at Aitape and Wewak.

Disadvantaged people

The most disadvantaged people in the district are the small numbers in the far south around Karielem and Wokien who have poor access to services and very low incomes. Most other people in the district earn very low incomes. Overall, people in Aitape-Lumi District are moderately disadvantaged relative to people in other districts of PNG. There is no agricultural pressure, land potential is high, access to services is moderate and cash incomes are very low.

Sandaun Province

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Total area (km²)</td>
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<td>Minor roads (km)</td>
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<td>Fans &amp; plains (%)</td>
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<tr>
<td>Floodplains &amp; swamps (%)</td>
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Nuku District covers the Torricelli Range, the Torricelli foothills and the northern side of the Sepik Valley including the Nopan, Wagasu and Nambilo rivers. Average annual rainfall ranges between 2100 and 3000 mm, increasing from north to south. Altitude varies from 50 m in the lower Wagasu floodplain, to over 1300 m on the Torricelli Range.

Population
The estimated rural population in the year 2000 is 42,000. The population density in the Torricelli foothills is 23 persons/km², while the far south of the district has only 3 persons/km².

Access to services
The Sepik Highway connects Nuku to Maprik and Wewak, but not to the provincial headquarters at Vaimo. The road is poorly maintained and often closed between Lumi and Maprik after extended rainfall. Periodic criminal activity between Maprik and Wewak also inhibits travel. A road from Aitape to Nuku is almost complete, but work on it is sporadic. A poorly maintained road runs south from Nuku. People in the Torricelli foothills require 4–8 hours’ travel to reach the nearest service centre, while those in the far south are very remote and require more than one day’s travel.

Income
Incomes are very low in the entire district and are derived from minor sales of cocoa, Robusta coffee and fresh food. Coca production is increasing in the Torricelli foothills.

Subsistence agriculture and nutrition
Sago is the most important food in the district. Coconut is also an important food. People in most areas also cultivate low intensity mixed staple gardens with one planting before a fallow period of more than 15 years. East of Nuku, people make low intensity yam gardens. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as very serious; 68 per cent of children were stunted and eight per cent were seriously under weight.

Land potential
The land potential in the Torricelli foothills around Nuku, Anguganak, Mukili, Mai and Ningil is high with no major limitations. The Sepik Valley, in the far south of the district, has low potential because of poor soils and long-term inundation. The Torricelli Range has low to moderate potential limited by steep slopes and frequent cloud cover.

Agricultural pressure and potential
There is no agricultural pressure in the district. There is potential for agricultural development in the Torricelli foothills given the high land potential and reasonable access to markets. Further road development through the Torricelli foothills, regular road maintenance along the Sepik Highway and the new road to Aitape are necessary to realise the full potential of the area. Coca production is a developing smallholder cash-earning activity and Robusta coffee is well established, but prices for the latter are low compared to other cash crops.

Disadvantaged people
The most disadvantaged people in the district are the small numbers in the far south around Warasai and Nabadua who are constrained by poor access to services, very low incomes and low potential environments. Most other people in the district earn very low incomes. Overall, people in Nuku District are seriously disadvantaged relative to people in other districts of PNG. There is no agricultural pressure, land potential is very high, access to services is moderate and cash incomes are very low. Child malnutrition is of serious concern.
Telefomin District covers the Torricelli foothills, the headwaters of the Sepik River and mountains of the West, Thurrowld, Fiamolu, Star and Victor Emmanuel ranges. Its shape, size and lack of transport infrastructure place severe limits on administration and the delivery of services. The Tekin and Ok Om rivers join the upper Strickland River that runs along the southeast border with Southern Highlands. Average annual rainfall ranges between 2700 and 4000 mm, increasing from north to south. Altitude varies from 50 m near Yellow River, to over 4000 m in the Star Mountains.

Population

The estimated rural population in the year 2000 is 35,000. The highest population density is in the Tekin Valley and is supplemented by low intensity mixed staple cultivation. People in the southern mountains cultivate low intensity taro gardens, while those around Okapamin make low intensity sweet potato gardens. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as serious; 66 per cent of children were stunted and six per cent were seriously under weight.

Land potential

The land potential in the lowland part of the Sepik Valley is low to moderate and is limited by poor soils, high rainfall and frequent flooding. The southern mountains have low potential caused by steep slopes, high rainfall and frequent cloudy cover, while the Tekin, Ok Om and Strickland valleys have low to moderate potential limited by steep slopes and frequent cloudy cover.

Telefomin District

- Total area (km²): 16333
- Occupied area (km²): 2413
- Airstrips: 21
- Major roads (km): 0
- Minor roads (km): 96
- Mountains & hills (%): 70
- Fans & plains (%): 20
- Floodplains & swamps (%): 10

Sandaun Province

Income

Incomes are low around Okapamin and Telefomin, and are derived from the sale of fresh food to the Ok Tedi mine in Western Province. Some people in these areas also receive remittances from relatives working at the mine. All other people in the district have very low incomes and have few cash-earning activities.

Subsistence agriculture and nutrition

Sago is the most important food in the lowland part of the Sepik Valley and is supplemented by low intensity mixed staple cultivation. People in the southern mountains cultivate low intensity taro gardens, while those around Okapamin make low intensity sweet potato gardens. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as serious; 66 per cent of children were stunted and six per cent were seriously under weight.

Agricultural pressure and potential

There is no agricultural pressure in the district. There is some potential for agricultural development in the Tekin Valley where people grow fresh vegetables for the Ok Tedi mine. There is little potential elsewhere in the district.

Disadvantaged people

The most disadvantaged people in the district are the large numbers in the southern mountains around Telefomin, Mianmin, Tumolbil and Yapiesi who earn very low incomes, have poor access to services and live in low potential environments. They have limited opportunities to improve their livelihoods. Smaller numbers of people in the lowland part of the Sepik Valley around Yilki, Yellow River, Wokikori and Eam have similar constraints. People in the Okapamin area are constrained by very low incomes and low potential environments. Overall, people in Telefomin District are extremely disadvantaged relative to people in other districts of PNG. There is no agricultural pressure, land potential is low, access to services is very poor and cash incomes are very low. Child malnutrition is of concern.
Vanimo-Green River District is in the northwest of Sandaun and covers the Vanimo Coast, Oenake Range, floodplains of the Nemayer River, Bewani plains, Serra Hills, Bewani Mountains and Border Mountains. The southeast of the district covers the Waro, North, Horden, Senu and Fairingi rivers, which are tributaries of the Sepik River. Average annual rainfall ranges between 2400 and 3600 mm, increasing from north to south. Altitude varies from sea level to over 1500 m in the Bewani Mountains.

Population
The estimated rural population in the year 2000 is 35,000. The highest population densities occur on the coastal plains around Vanimo where there are 84 persons/km². The Oenake Range, Serra I Hills, Bewani plains and Border Mountains have 14 persons/km², while the far southeast of the district has very low densities of 3 persons/km². Over half of the district is unoccupied.

Access to services
People on the Vanimo coastal plains require less than one hour’s travel to reach Vanimo. Those in the Oenake Range, Serra I Hills, Bewani plains and Border Mountains require 4–8 hours’ travel to reach the nearest service centre, while those in the far southeast require more than one day’s travel. There is a good road from Vanimo to the border with Irian Jaya, which continues on to Jayapura, and a road of lesser quality that runs inland to Bewani. Forestry roads extend through the Nemayer floodplains and Serra Hills and are planned to connect with roads from Aitape.

Income
Incomes are low on the Vanimo coastal plains and are derived from the sale of betel nut and fresh food. People in the remainder of the district earn very low incomes from minor sales of betel nut, fresh food, rubber and tobacco. Limited numbers of people receive wages and royalties from forestry operations in the Oenake Range, Nemayer floodplains and Serra Hills. Small numbers of people import and sell goods from Jayapura in Irian Jaya.

Subsistence agriculture and nutrition
Sago is the most important food in the district and is supplemented by low intensity mixed staple cultivation. There is one planting before a fallow period of more than 15 years. People on the coastal plains around Vanimo cultivate low intensity mixed staple gardens. In this area, sago and coconut are also important foods. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as serious; 43 per cent of children were stunted and nine per cent were seriously under weight.

Land potential
Land potential in the Oenake Range, Serra Hills, Bewani foothills and Border Mountains is high to very high but is limited in places by steep slopes. The Bewani plains, Nemayer floodplains, Vanimo coastal plains and the far southeast of the province have low to moderate potential caused by poor soils and frequent flooding. The Bewani Mountains have low potential as a result of steep slopes and frequent cloud cover.

Agricultural pressure and potential
There is no agricultural pressure in the district. There is potential for agricultural development in the Oenake Range and Serra Hills given the high to very high land potential and reasonable access to markets in Vanimo. The Bewani foothills and Border Mountains have high potential land but poor access to markets. Cocoa, fresh food and betel nut production are established smallholder cash-earning activities in these areas.

Disadvantaged people
The most disadvantaged people in the district are the small numbers in the far southeast of the province around Green River, Kwomtari and Giurua where access to services is poor, incomes are very low, and in some places, there are low potential environments. Most other people in the district earn very low incomes. Overall, people in Vanimo-Green River District are seriously disadvantaged relative to people in other districts of PNG. There is no agricultural pressure, land potential is high, access to services is poor and cash incomes are very low. Child malnutrition is of concern.

Vanimo-Green River District

<table>
<thead>
<tr>
<th>Total area (km²)</th>
<th>10295</th>
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<tbody>
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<td>Occupied area (km²)</td>
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<td>Airstrips</td>
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<td>Minor roads (km)</td>
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<tr>
<td>Mountains &amp; hills (%)</td>
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<td>Farms &amp; plantations (%)</td>
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<tr>
<td>Floodplains &amp; swamps (%)</td>
<td>9</td>
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</tbody>
</table>
Manus Province

Small tubers affected by low soil fertility. High population densities in poor environments have resulted in strong agricultural pressure on some small islands in the province. People do not use land improvement practices to maintain crop productivity, and this has resulted in soil fertility decline and reduced crop yields. On several of the very small islands in the province, agriculture is limited and people depend on trade to survive, exchanging fish and coconuts for sago and garden produce.

Fish for sale in the Lorengau market. The sale of fish and other marine produce is an important smallholder cash-earning activity in the province, especially for people living on the very small islands north, west and south of Manus Island. Other sources of income include fresh food, betel nut and copra. There are a large number of well-educated Manus people who live and work elsewhere in PNG. Overall, cash remittances probably contribute more to annual incomes than any of the agricultural commodities.
Manus comprises approximately 2000 km² of islands in the far north of PNG. It is the smallest province in the country, both in land area and population. Manus Island is the largest island in the province and is dominated by hills and the mountain peaks of Mt Dremsel, Mt Tapalow and Mt Chayer. The coastal areas include limestone plains, swamps and the floodplains of the Luis, Warei, Malai, Uganda, Kauwa, Drangoi and Tingau rivers. There is a causeway between Los Negros and Manus islands that connects the provincial airport at Momote to Lorengau, Rambutyo, Lou and Baluan islands, southeast of Manus Island, have mountainous interiors surrounded by narrow limestone plains. Most of the remaining islands in the province are small raised coral limestone plains, located close to Manus Island. Four groups of islands, however, are distant from Manus Island. The Asia-Wavulu Islands are about 400 km to the west, the Ninigo Group is 280 km to the west, the Hermit Islands are 170 km to the west, and the Kaniet Islands are 200 km to the northwest of Manus Island. Altitude in the province varies from sea level to over 700 m on Mt Dremsel. Most people live near sea level. Average annual rainfall is 3500 mm on most islands. There is only one district in the province, also named Manus.
The estimated rural population of Manus in the year 2000 is 37,000, which is one per cent of the national rural population. The provincial rural population growth rate is high at three per cent per annum. The highest population densities are on the small islands off the north coast of Manus (Harengan, Arowe, Sori, Pumam, Andra, Hua, Oneta, Pityulu, Hawe and Ndiro islands) and off the south coast (Mbuake, Johnston, Ndrova and Tilian islands) where there is an average of 500 persons/km$^2$. Bipi, Sisi and Pahi islands to the west of Manus have densities of 250 persons/km$^2$, while Balaun, Pam and Nauna islands to the south have 125 persons/km$^2$. The remote Aua-Wuvulu, Ninigo, Hermit and Kaniet island groups have densities of 65 persons/km$^2$, while Ramburuy, Tong, Pak and Los Negros islands to the east of Manus have 25 persons/km$^2$. Manus Island itself has relatively low densities of 25 persons/km$^2$ in the east and 7 persons/km$^2$ in the west and contains the majority of the provincial population.
There is a good quality road from Momote airport to Lombrum and Lorengau, and a network of minor roads in the eastern part of Manus Island. However, outboard motor boats and canoes are the most common means of transport in the province. Most people in the province require 4–8 hours' travel to reach Lorengau. People in the Aua-Wuvulu, Ninigo, Hermit and Kaniet island groups are very remote and require more than one day's travel to reach Lorengau or Wewak. The Aua-Wuvulu and Ninigo island groups are closer to Wewak in East Sepik Province, than to Lorengau and were previously administered and serviced from Wewak.
Most people in the province have moderate to high incomes derived from the sale of copra, betel nut, fresh food, fish and cocoa. People closer to markets in Lorengau tend to have higher incomes. People in the Ava-Wuvulu, Ninigo, Hermit and Kaniet island groups earn low incomes from minor sales of copra. The major source of non-agricultural income in the province is remittances from relatives working in urban centres elsewhere in PNG. People from Manus Province have a long history of gaining advanced education, working elsewhere and sending money home.
Sago is the most important food on Manus Island and is supplemented by low intensity mixed staple cultivation. On Bipi, Sisi and Pahi islands, people cultivate high intensity mixed staple gardens. There are 3–5 consecutive plantings before a fallow period of 1–4 years. People on most other islands in the province make low intensity mixed staple or sweet potato gardens. There is minimal agriculture on the small islands off the immediate north and south coasts of Manus Island where there are very high population densities. Livelihoods are mostly based on fishing and trading, though in areas where there is access to land some people cultivate gardens close to their houses. Coconut is an important food in the entire province. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as fair; 30 per cent of children were stunted and three per cent were seriously under weight.
The land potential is high to very high on Los Negros, Lou, Baluan and Horno islands. Rainfall, soils, slope, light and temperature are ideal for the production of many crops. The central and eastern hills of Manus Island have moderate potential constrained by high rainfall. Most of the smaller islands have moderate to high potential limited by high rainfall and poor soils that are prone to rapid fertility decline. The northern and western hills of Manus Island have low potential due to steep slopes, poor soils and high rainfall. Swamp areas on the floodplains of the Uganda and Kauwa rivers have very low potential.

Diagrammatic Insets

- Very high potential
- High potential
- Moderate potential
- Low potential
- Very low potential
- Unoccupied land

District boundaries

Ava-Wuvulu Islands
Ninga Group
Anchorite (Kaniet Islands)
Hermit Islands

Manus

Number of people

0
20 000
40 000
60 000
80 000

Kilometres
There is very strong agricultural pressure on Bipi, Sisi and Pahi islands resulting from intensive agriculture being practised in poor to moderate environments. These areas are prone to declining crop yields and food shortages. There is potential for agricultural development on the central and eastern hills of Manus Island where there is moderate potential land, low population densities and good access to markets. Cocoa, copra, betel nut and fresh food are established cash-earning activities. Most islands with high and very high land potential, perhaps with the exception of Lou Island, are unsuitable for agricultural development because of existing land shortages.
The most disadvantaged people in the province are those in the Aua-Wuvulu, Ninigo, Hermit and Kaniet island groups where access to services is poor. Small numbers of people on Bipi, Sisi and Pahi islands are constrained by very strong agricultural pressure and are vulnerable to the effects of land degradation, declining crop yields and food shortages. In the east of Manus Island, people live in low potential environments. Those on Haerangg, Anwee, Sori, Pouam, Andra, Hua, Oseta, Pityulu, Hawei, Ndile, Mbuke, Johnston, Ndrova, Tilianu, Balusa, Pam and Nauna islands are disadvantaged by very high population densities, which lead to land shortages. Overall, people in Manus District are slightly disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is moderate, access to services is good and cash incomes are moderate.
Children walk through a large coconut plantation. Copra production is an important smallholder cash-earning activity in New Ireland. Other significant sources of income in the province include fresh food, fish and royalties from the Lihir gold mine. Throughout PNG, the copra industry has declined over the past decade due to high shipping costs, low returns on labour and the re-allocation of resources to other cash-earning activities, particularly betel nut, cocoa and oil palm.

New Ireland Province

A road on New Ireland made from coralline materials. There is a network of good quality roads on most of New Ireland, largely because of an abundance of coralline road building material. These roads provide reliable access to services and markets. There are some roads on the smaller islands in the province, but few vehicles.
New Ireland is in the northeast of PNG and consists of 9600 km² of small island groups and the main island of New Ireland. The outer edge of the island of New Ireland is made up of narrow coastal limestone plains, floodplains and hills. The north of the island is dominated by the plains and floodplains of Balgai Bay and the mountains of the Schleinitz Range that extend from Kaur in the north to the Leler Plateau in the middle of the island. The narrow northern part of the island, between Kuru Bay and Namatanai, is dominated by low altitude hills. The south of the island is dominated by the high Hans Meyer Range, Verron Range and the valleys of the Kandaru and Weini rivers. The islands in the province include East, Tabar, Lihir, Anir and Tanga island groups and the islands of Lavongai, Dyaul and Tingwon. Most of these islands have mountains in the centre of over 500 m, which are surrounded by narrow limestone plains and floodplains. The altitude on New Ireland varies from sea level to over 2000 m in the Hans Meyer and Verron ranges. Most people live between sea level and 300 metres. The highest place where agriculture is practiced is on the Leler Plateau at 1000 metres. Average annual rainfall ranges from 2800 to 3200 mm on New Ireland and Lavongai, with extremes of 3600 mm on the small island groups. An important goldmine is located on Lihir Island. The two districts in New Ireland are Kavieng and Namatanai.
The estimated rural population of New Ireland in the year 2000 is 133,000, which is three per cent of the national rural population. The provincial rural population growth rate is very high at four per cent per year. The highest population densities of 162 persons/km$^2$ are on the East Islands, off Lavongai, and on the Tingwon Islands. Mahur and Maahet islands, in the Lihir Group, and Boang Island, in the Tanga Group, have similar densities. The coastal plains of Lavongai, Lihir and Malendok islands and the Anir Islands have moderate densities of 47 persons/km$^2$, while most of New Ireland has 30 persons/km$^2$. All remaining areas in the province have low population densities. Areas around Kavieng and Namatanai have significant in-migration.
The Bulominski Highway, constructed almost 100 years ago during the German colonial period, connects Kavieng to Namatanai via the east coast. Many sections are sealed and the unsealed parts have a good gravel surface. There are minor roads in all other coastal areas of New Ireland, but some are now in poor condition. Most of the islands have some road development in coastal areas. Outboard motor boat and canoe travel are used in coastal areas and between islands. People on New Ireland to the north of Namatanai, those on the coastal areas of Lavongai Island and on Dyaul Island require less than four hours’ travel to Kavieng or Namatanai. People in the far south of New Ireland and in the island groups require 4–8 hours’ travel to reach Kavieng or Namatanai. Most of the island groups have at least one airstrip that is serviced by scheduled passenger flights.
On most of New Ireland, and on the coastal areas of Lavongai and Dyaul islands, incomes are high and are derived from the sale of copra, cocoa, oil palm, betel nut, fish and fresh food. People on the Lellet Plateau earn high incomes from the sale of fresh food. People in the inland areas of Lavongai Island earn moderate incomes from the sale of betel nut, fresh food and tobacco. Incomes are low in the very south of New Ireland and on the island groups, and are derived from minor sales of cocoa, copra, fish, fresh food and betel nut.

Many sources of non-agricultural income exist on the northeast coast of New Ireland. People run small businesses, PMVs and trade stores, and gain wage employment from both businesses and plantations. A limited number of people on the southeast coast receive wages from cocoa and oil palm plantations. People on Lihir Island receive significant income in the form of wages and royalties from the gold mining operations, but the distribution of this income is very restricted.
Agriculture in New Ireland Province is relatively diverse. Coconut is an important food in all coastal areas. Most people on New Ireland, Mussau Island and in the Anir, Tanga, and Lihir island groups cultivate low intensity sweet potato gardens, with either yam or taro as co-dominant staples. There are 1–2 plantings before a fallow period of more than 15 years. People on Mali, Masahet and Mahur islands, in the Lihir Group, make moderate intensity mixed staple gardens with two consecutive plantings before a fallow period of 1–4 years. People on the Tabar Islands and in the interior of Lavongai Island cultivate low intensity sweet potato and cassava gardens. Sago is the most important food on the coast of Lavongai and Dyaul islands and at Balgai Bay, and is supplemented by low intensity mixed staple or sweet potato cultivation.
Land potential is high to very high on the southeast coastal plains and hills of New Ireland from Karu Bay to Manga. Rainfall, slope, light and temperature are ideal for the production of many crops, but the limestone soils which are found in the area are prone to rapid fertility decline. The Kaur area has high potential limited by frequent cloud cover, while the coastal plains of the Tabar, Lihir and Anir island groups have high potential constrained by high rainfall. Moderate potential land exists in the northern hills of Lavongai Island, on Dyaul Island and in the inland areas of the Tabar and Anir island groups. The northeast coastal plains, the southeast coastal hills and isolated parts of the west coast of New Ireland also have moderate potential. Common limitations include steep slopes, poor soils and frequent cloud cover. The inland mountains of New Ireland and the island groups have low potential with similar constraints.
There is moderate agricultural pressure in the hills around Namatanai and on Boang Island in the Tanga Group. There is marginal pressure in the Tabar Islands. Areas of marginal pressure will be of concern if agriculture continues to intensify without the adoption of suitable land management practices. There is potential for agricultural development on the southeast coast of New Ireland, from Karu Bay to Manga, where there is high to very high potential land and good access to markets. In these areas cocoa, copra, betel nut, fresh food and, more recently oil palm, are established smallholder cash-earning activities. The Kaut area also has potential for development given the high land potential and close proximity to Kavieng. Copra, cocoa and fresh food are established smallholder cash-earning activities in the area.
The most disadvantaged people in the province are those in the moderate agricultural pressure areas around Namatanai and on Boang Island. These areas are vulnerable to land degradation and declining crop yields. Large numbers of people in central New Ireland and on Lihir, Lavongai and Manus islands are limited by low potential environments, while smaller numbers of people on Malo, Maashe and Mahur islands in the Lihir Group, have very low incomes. People in the East Islands and on Tingwon Island are disadvantaged due to land shortages which are caused by very high population densities. People on these islands are also vulnerable to food and water shortages during periods of drought.

**Disadvantaged people**

![Map showing disadvantaged areas in New Ireland Province](image)

- **Inset 1**
  - **Kavieng**
  - **Namatanai**
  - **Konos**
  - **Taskul**
  - **Kilometres**

- **Legend**:
  - Moderate pressure
  - Poor environment
  - Very low income
  - Not disadvantaged (relative to other areas)
  - Unoccupied land
  - District boundaries
  - District boundaries

Papua New Guinea Rural Development Handbook — New Ireland Province
Kavieng District

Kavieng District is in the north of the province and includes New Ireland, north of Keros, and the Lavongai, Dyaul, Saint Matthias and Tingwon islands. New Ireland, Lavongai and Mussau islands have mountains surrounded by coastal limestone plains and floodplains. Average annual rainfall is 3800 mm in the Saint Matthias Islands, while the rest of the district receives around 3000 millimetres. Altitude varies from sea level to over 900 m on Lavongai Island.

Population

The estimated rural population in the year 2000 is 56 000. The highest population densities are on the East Islands and Tingwon Island with 162 persons/km$^2$. The coastal plains of Lavongai Island have moderate densities of 47 persons/km$^2$, while New Ireland and Dyaul Island have 30 persons/km$^2$. The Saint Matthias Islands support 16 persons/km$^2$, while the interior of Lavongai Island has 4 persons/km$^2$. The Kaut hills and coastal plains, southeast of Kavieng, have significant in-migration. The population of the Tigak and East Coast Kara Nalik census divisions increased by an average of eight per cent per year between 1980 and 1990. These are fast growing populations.

Access to services

People on New Ireland, in the coastal areas of Lavongai Island, and on Tingwon and Dyaul islands require less than four hours’ travel to reach Kavieng, while people in the Saint Matthias Islands and those in the interior of Lavongai Island require 4–8 hours’ travel. There are good roads in the coastal areas of New Ireland and minor roads on Lavongai, Dyaul and Mussau islands. Outboard motor boat and canoe travel are used along the coast and between the islands.

Income

Incomes are high on New Ireland, in the coastal areas of Lavongai Island, and on Tingwon and Dyaul islands, and are derived from the sale of copra, cocoa, oil palm, betel nut, fish and fresh food. People in the inland areas of Lavongai Island and in the Saint Matthias Islands earn moderate incomes from sales of betel nut, fresh food, tobacco, copra and fish. Many sources of non-agricultural income exist in the northeast of New Ireland.

Subsistence agriculture and nutrition

Agriculture on the coastal plains of New Ireland and in the Saint Matthias Islands is characterised by low intensity sweet potato and taro cultivation. Bagu is the most important food on the coast of Lavongai and Dyaul islands and at Balgai Bay and is supplemented by low intensity mixed staple or sweet potato cultivation. People in the interior of Lavongai Island cultivate low intensity mixed staple gardens. Coconut is an important food in all coastal areas. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as poor; 36 per cent of children were stunted and three per cent were seriously under weight.

Land potential

Land potential is very high in the Tingwon Islands with no limitations. The Kaut hills have high potential limited by frequent cloud cover. The northern hills of Lavongai Island have moderate potential with frequent cloud cover, while the east coast plains of New Ireland, Dyaul and Emirau islands and the East Islands have moderate potential with poor soils. Mussau Island has low potential constrained by high rainfall and frequent cloud cover, while the mountains of New Ireland and Lavongai Island have low potential due to steep slopes, poor soils and frequent cloud cover.

Agricultural pressure and potential

There is some marginal agricultural pressure near Kaut and in the East Islands. This will be of more concern in the future if agriculture continues to intensify without the adoption of suitable land management practices. There is potential for agricultural development in the Kaut hills given the high land potential and close proximity to Kavieng. Copra, cocoa and fresh food are established smallholder cash-earning activities in the area.

Disadvantaged people

The most disadvantaged people in the district are the large numbers on Mussau Island, Lavongai Island and on the west coast of New Ireland who live in low potential environments. People in the East Islands and on Tingwon Island are also at a disadvantage due to very high population densities, which lead to land shortages. As a result, people become vulnerable to food and water shortages during periods of drought. Overall, people in Kavieng District are slightly disadvantaged relative to people in other districts of PNG. There is no agricultural pressure, land potential is moderate, access to services is good and cash incomes are high.
New Ireland Province

Namatanai District

is in the south of the province and includes New Ireland, south of Keros, and the Tabar, Lihir, Tanga and Anir island groups. New Ireland includes the Schleinitz, Hans Meyer and Veron ranges which are surrounded by narrow coastal limestone plains, floodplains and hills. Average annual rainfall is 3000 mm on New Ireland, while the offshore islands receive 3500 millimetres. Altitude varies from sea level to over 2000 m in the Veron Range.

Population

The estimated rural population in the year 2000 is 77 000. The highest population densities are on Mali, Mahur and Masahet islands in the Lihir Group, and on Boang Island in the Tanga Group, with 210 persons/km². The coastal plains of Lihir and Malendok islands and the Anir Islands have moderate densities of 47 persons/km², while the central part of New Ireland has 30 persons/km².
The far south of New Ireland and the Tabar Islands have low densities of 16 persons/km². The southeast coast around Namatanai has significant in-migration. The population of the East Coast Namatanai census division increased by 5.1 per cent per year between 1980 and 1990.

Access to services

People in New Ireland north of Manga, require less than four hours’ travel to reach Namatanai or Kavieng, while those south of Namatanai and in the island groups require 4–8 hours’ travel. The Bulominski Highway connects Kavieng to Namatanai along the east coast. There are minor roads in most coastal areas of New Ireland and on the island groups, but many are in poor condition. Outboard motor boat and canoe travel are common along the coast and between the islands.

Income

Cash incomes on New Ireland north of Manga, are high and are derived from sales of copra, cocoa, oil palm, betel nut, fish and fresh food. In the south of New Ireland and on the island groups, people earn low incomes from sales of cocoa, copra, fish, fresh food and betel nut. Small numbers of people on the southeast coast of New Ireland receive wages from cocoa and palm oil plantations. People on Lihir Island receive wages and royalties from gold mining operations.

Subsistence agriculture and nutrition

Agriculture on New Ireland and in the Anir, Tanga, Tabar and Lihir islands is characterised by low intensity sweet potato cultivation, with either taro, cassava or yam as co-dominant staples. People on Mali, Masahet and Mahur islands cultivate moderate intensity mixed staple gardens and make two consecutive plantings before a fallow period of 1–4 years. Coconut is an important food in all coastal areas. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as fair; 34 per cent of children were stunted and two per cent were seriously under weight.

Land potential

Land potential is high to very high on the southeast coastal plains and hills of New Ireland from Karu Bay to Manga, but the limestone soils which are found in the area are prone to rapid fertility decline. The coastal plains of the Tabar, Lihir and Anir islands have high potential limited by high rainfall.

There is moderate potential land in the inland areas of the Tabar and Anir islands. The southeast coastal hills and isolated parts of the west coast of New Ireland also have moderate potential land. Common limitations include steep slopes, poor soils and frequent cloud cover. The mountains of New Ireland have low potential with similar constraints.

Agricultural pressure and potential

There is moderate agricultural pressure in the hills around Namatanai and on Boang Island, in the Tanga Group. There is marginal pressure in the Tabar Islands. Potential for agricultural development exists on the northeast coast of New Ireland, from Karu Bay to Manga, where land potential is high to very high and access to markets is good. Cocoa, copra, betel nut, fresh food, and more recently oil palm, are established smallholder cash-earning activities in the area.

Disadvantaged people

The most disadvantaged people in the district are those in the moderate agricultural pressure areas around Namatanai and on Boang Island. These people are vulnerable to land degradation and declining crop yields. Large numbers of people in central New Ireland and on Lihir Island are constrained by low potential environments, while people on Mali, Masahet and Mahur islands, in the Lihir Group, have very low incomes. Overall, people in Namatanai District are slightly disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is moderate, access to services is moderate and cash incomes are high.

<table>
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<th>Total area (km²)</th>
<th>6574</th>
<th>Occupied area (km²)</th>
<th>2477</th>
<th>Airstrips</th>
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<th>Major roads (km)</th>
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<th>Minor roads (km)</th>
<th>527</th>
<th>Mountains &amp; hills (%)</th>
<th>82</th>
<th>Fans &amp; plains (%)</th>
<th>18</th>
<th>Floodplains &amp; swamps (%)</th>
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</table>
An infant sits in a wheelbarrow full of cocoa. These cocoa pods are being transported for village-level fermentation. Plantation and smallholder cocoa development in the northeast of the Gazelle Peninsula has created one of the most well-developed areas in PNG. Cocoa is an important lowland cash crop and support for smallholder production is increasing through targeted research and extension programs. Other established sources of agricultural income include copra, betel nut and fresh food. There is widespread interest in alternative cash crops such as balsa and vanilla.

A woman removes the husks from coconuts. Copra production was once an important source of cash income along the south coast of New Britain, including in the Pomio area. The industry has collapsed over the past decade due to high shipping costs, sporadic production and low returns on labour. This has contributed to Pomio District having some of the most disadvantaged people in PNG. A low-cost and reliable coastal shipping service could improve access to services and raise household incomes.

East New Britain Province
East New Britain includes roughly 1500 km² of the island of New Britain, in the northeast of PNG. The Gazelle Peninsula is in the north of the province and encompasses the Baining Mountains, the valleys of the Keravat and Warangoi rivers, numerous smaller rivers and narrow coastal plains. In the northeast of the Gazelle Peninsula are fertile hills and plains that surround the Rabaul volcanoes. The area is densely settled and well-developed. Past volcanic eruptions have covered the area in fertile volcanic ash, but the 1994 eruptions caused widespread damage to infrastructure, cash crops and water supplies. The Duke of York Islands are 20 km northeast of Kokopo, and Watom Island is 10 km north of Rabaul. The south of the province is dominated by the Nakanai Mountains, extensive limestone plateaux, narrow coastal plains and the active volcanic peaks of Mt Ulawun and Mt Bamus. Altitude varies from sea level to over 2000 m on Mt Ulawun, Mt Bamus and Mt Berurumea. The highest altitude where agriculture is practised is 1200 m on the Masmau Plateau and in the Baining Mountains. Average annual rainfall varies from 2000 mm near Kokopo, to over 5000 mm on the south coast. There are moderate dry seasons in the northeast of the Gazelle Peninsula. The four districts in East New Britain are Gazelle, Kokopo, Pomio and Rabaul.
The estimated rural population of East New Britain in the year 2000 is 247,000, which is six per cent of the national rural population. The provincial rural population growth rate is a very high 4.2 per cent per year. The highest population densities are on the volcanic hills and plains of the Gazelle Peninsula, in the Duke of York Islands and on Watom Island, with an average of 220 persons/km². The coastal plains around Pomio have a population density of 78 persons/km², while the coastal plains around Uvol have 55 persons/km². Most other areas in the province have moderate to low densities that average 25 persons/km². There is significant in-migration in the northeast of the Gazelle Peninsula, with people from many parts of PNG seeking better access to services, more productive environments and wage employment opportunities provided by the towns and plantations.
The northeast of the Gazelle Peninsula has an extensive network of sealed roads. Good quality roads extend into the Baining Mountains and along the north coast to Laual Bay. A road of lesser quality crosses the island from Hoskins in West New Britain Province, to Amio and Uvol. There are few roads in the south of the province. Outboard motor boat and canoe travel are common in coastal areas. People in the northeast of the Gazelle Peninsula require less than one hour’s travel to reach Kokopo, while those in the west Baining Mountains, in the Duke of York Islands and on Watom Island require less than four hours’ travel. People on the south and northwest coasts require 4–8 hours’ travel to reach the nearest service centre, while those in the inland mountains of Pomio District are very remote and require more than one day’s travel.
The northeast of the Gazelle Peninsula, including the Duke of York Islands, is one of the wealthiest areas in PNG. People earn high to very high incomes from the sale of cocoa, betel nut, fresh food, copra and fish. There are low incomes in the west Baining Mountains derived from the sale of fresh food. People in all other areas in the province earn very low incomes from minor sales of cocoa, copra and fresh food. There are many sources of non-agricultural income in the northeast of the Gazelle Peninsula. People run small businesses such as PMVs, trade stores and cocoa fermentaries; and gain wage employment from businesses and plantations. A limited number of people in the Baining Mountains, in the inland Pomio area and in other coastal areas receive wages and royalties from forestry operations.
Agriculture on the volcanic plains and hills of the Gazelle Peninsula and in the Duke of York Islands is dominated by high intensity banana cultivation, supplemented by Chinese taro and sweet potato. Here, coconut is an important food, and triploid bananas can produce for 20 years if they are managed properly. There are two consecutive plantings before a fallow period of 5–10 years. Tillage and the rotation of legumes between plantings are used to improve production. Agriculture in the lower Keravat and Warangoi valleys is similar, but less intensive. People in the Baining Mountains cultivate low intensity Chinese taro gardens, while those on the northwest and southeast coasts make low intensity mixed staple gardens. Agriculture in the Nakanai Mountains and on the south coast is characterised by low intensity sweet potato cultivation. Coconut is an important food in all coastal areas.
The land potential is high to very high on the volcanic plains and hills of the Gazelle Peninsula, on Watom Island and in the Duke of York Islands. The land in these areas is among the most productive in PNG. Rainfall, soils, slope, light and temperature are ideal for the production of many tropical crops. The plains and hills on the southeast coast have moderate potential due to poor soils and high rainfall. The Baining Mountains have very low to moderate potential constrained by steep slopes and frequent cloud cover. While the plains and hills on the southwest coast have low potential caused by poor soils, steep slopes and very high rainfall. The Nakanai Mountains and inland areas have very low to low potential due to steep slopes, poor soils, high rainfall and frequent cloud cover.
Based on the measures used in this handbook, there is no agricultural pressure in the province. However, there is concern over gullying and soil erosion on the volcanic soils of the Gazelle Peninsula.

There is potential for agricultural development in the Warangoi and Keravat valleys, and in the coastal plains and valleys of Atalikikun Bay, where land potential is moderate to very high and access to markets is good. Cocoa, betel nut, fresh food and copra are established smallholder cash-earning activities in these areas. Existing cash crop development and very high population densities limit the agricultural potential on the volcanic plains and hills of the Gazelle Peninsula. The southeast coast has potential for agricultural development given the moderate land potential, but access to markets depends on expensive coastal shipping. This was the main reason for the collapse of the copra industry on the south coast during the 1980s.
The most disadvantaged people in the province are those in the Nutuve and Leli areas inland of Pomio, the Melkoi and Tosolu valleys inland of Uvol, and on the Mamusi Plateau. Here, large numbers of people have limited opportunities to improve their livelihoods due to low potential environments, very low incomes and poor access to services. Large numbers of people on the south coast around Uvol, and on the northwest coast between Lassul and Open Bay, are constrained by low potential environments and very low incomes. People in the southeast of the Baining Mountains and on the southeast coast, between Warangoi Bay and Cape Oxford, earn very low incomes.
Gazelle District is in the northwest of the Gazelle Peninsula and covers the volcanic plains and hills around Mt Varzin, the Keravat Valley; the north side of the Warangoi Valley; the Baining Mountains; and the coastal plains from Ataliklikun Bay in the north to Open Bay in the southwest. Average annual rainfall ranges between 2200 and 3800 mm, increasing from northeast to southwest. Altitude varies from sea level to over 1000 m in the Baining Mountains.

Population
The estimated rural population in the year 2000 is 93,000. The highest population density of 220 persons/km² is on the volcanic plains and hills. The Baining Mountains, the north coast plains and valleys and the west coast plains support densities of 23 persons/km², while the lower Keravat and Warangoi valleys have low densities of 10 persons/km². The western half of the district is mostly unoccupied. The volcanic plains and hills have significant in-migration. The population of the Toma and Central census divisions increased by an average of eight per cent per year between 1980 and 1990.

Access to services
People on the volcanic plains and hills, on the coast of Ataliklikun Bay, and in the Keravat and Warangoi valleys require less than one hour’s travel to reach Kokopo. People in the Baining Mountains require less than four hours’ travel, while those on the north and west coasts require 4–8 hours’ travel to reach Kokopo. There is a network of sealed roads on the volcanic plains and hills, gravel surfaced roads connect Lassul on the north coast to the western Baining Mountains.

Income
Incomes are high to very high on the volcanic plains and hills, on the coast of Ataliklikun Bay and in the lower Keravat and Warangoi valleys, and are derived from the sale of cocoa, betel nut, fresh food and copra. People in the Baining Mountains earn low incomes from the sale of fresh food, while those on the north and west coasts earn very low incomes from minor sales of cocoa, copra and fresh food. Other sources of income in the district are derived from small-scale enterprises such as cocoa fermenting, trade stores, construction, and also from wage employment from businesses and plantations. Small numbers of people in the Baining Mountains receive wages and royalties from forestry operations.

Subsistence agriculture and nutrition
Agriculture on the volcanic plains and hills is dominated by high intensity banana cultivation. Fenn, coconut is also an important food and rippled bananas can produce for 20 years if they are managed properly. People make two consecutive plantings before a fallow period of 5–10 years. Agriculture in the area to the southwest is similar, but is less intensive. People in the Baining Mountains and on the north and west coasts cultivate low intensity mixed staple gardens. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as relatively low; 33 per cent of children were stunted and one per cent were seriously underweight.

Land potential
The land potential is high to very high on the volcanic plains and hills, the coast and inland valleys of Ataliklikun Bay, and in the Keravat and Warangoi valleys. The very high potential land is among the most productive in PNG. Rainfall, soils, slope, light and temperature are ideal for the production of many crops however, gullying and soil erosion is a problem in some places. The Baining Mountains have very low to moderate potential due to steep slopes, poor soils and frequent cloud cover, while the north and west coasts have low potential constrained by poor soils and frequent flooding.

Agricultural pressure and potential
There is no agricultural pressure in the district. The potential for further development on the volcanic plains and hills is limited by existing development and very high population densities. At present, people are squatting or leasing land for subsistence agriculture and there are concerns over soil erosion on the steeper slopes. There is potential for agricultural development in the Warangoi and Keravat valleys and on the coastal plains and valleys of Ataliklikun Bay where land potential is moderate to very high and access to markets is good. Cocoa, betel nut and fresh food are established smallholder cash-earning activities in these areas.

Disadvantaged people
The most disadvantaged people in the district are those on the coast between Lassul and Open bays, who are constrained by low potential environments and very low incomes. These people have limited opportunities to improve their livelihoods. Small numbers of people in the Baining Mountains live in low potential environments. Overall, people in Gazelle District are not disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is very high, access to services is very good and cash incomes are very high.
Kokopo and Rabaul districts are in the northeast of the Gazelle Peninsula. Both districts are small and semi-urban in nature. They cover the volcanic peaks around Simpson Harbour and the volcanic plains that extend north of the Waragoi River to Kokopo. The limestone plains on the east coast between Cape Gazelle and Waragoi Bay, Watom Island and the Duke of York Islands. Average annual rainfall ranges from 2000 mm around Kokopo, to 2500 mm on the Duke of York Islands. Altitude varies from sea level to over 500 m on the Rabaul volcanoes.

Population
The estimated rural population in the year 2000 is 92,000. The population density is 220 persons/km² in the rural areas of both districts. After the destruction caused by the 1994 volcanic eruption, there was significant out-migration of people from the Rabaul area.

Access to services
All people on the mainland are less than one hour’s travel to the nearest service centre, while those on Watom and the Duke of York islands require less than four hours travel. There is a network of sealed roads in the mainland areas. Outboard motor boat travel is common along the coast and between the mainland and the islands.

Income
Incomes are very high in the mainland areas and are derived from the sale of cocoa, betel nut, fresh food and copra. People on Watom and the Duke of York islands earn high incomes from the sale of copra, cocoa, fresh food, fish and betel nut. Other sources of income in the district include small business activities and wage employment from businesses and plantations.

Subsistence agriculture and nutrition
Agriculture on Watom and the Duke of York islands is dominated by high intensity banana cultivation, with Chinese taro, sweet potato and cassava as other important crops. Coconut is also an important food and triploid bananas can produce for up to 20 years if they are managed properly. People make 3–5 plantings before a fallow period of 1–4 years. Agriculture on the mainland is similar, but is less intensive. Fèe, peanuts are planted in rotation with root crops. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as fair. In Rabaul District, 30 per cent of children were stunted and seven per cent were seriously underweight. In Kokopo District, 26 per cent of children were stunted and seven per cent were seriously underweight.

Land potential
The land potential is high to very high in most areas of both districts and this land is among the most productive in PNG. Rainfall, soils, slope, light and temperature are ideal for the production of many crops. The limestone plains on the east coast, between Waragoi Bay and Cape Gazelle, have moderate to high potential.

Agricultural pressure and potential
There is no agricultural pressure in either district. However, changes in fallow vegetation and soil erosion on slopes suggest that very high population densities and land shortages are causing some localised problems. Potential for further agricultural development is limited by very high population densities and existing plantation and smallholder cash crop development.

Disadvantaged people
There are no disadvantaged people in either district, as defined by the criteria used in this handbook. Overall people in Rabaul and Kokopo districts are not disadvantaged relative to people in other districts in PNG. There is some agricultural pressure, land potential is very high, access to services is very good and cash incomes are very high.

<table>
<thead>
<tr>
<th>Kokopo District</th>
<th>Rabaul District</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total area (km²): 408</td>
<td>Total area (km²): 95</td>
</tr>
<tr>
<td>Occupied area (km²): 209</td>
<td>Occupied area (km²): 58</td>
</tr>
<tr>
<td>Airstrips: 2</td>
<td>Airstrips: 0</td>
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<tr>
<td>Major roads (km): 38</td>
<td>Minor roads (km): 10</td>
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<tr>
<td>Minor roads (km): 76</td>
<td>Major roads (km): 36</td>
</tr>
<tr>
<td>Mountains &amp; hills (%): 2</td>
<td>Mountains &amp; hills (%): 71</td>
</tr>
<tr>
<td>Farms &amp; plants (%): 98</td>
<td>Farms &amp; plants (%): 29</td>
</tr>
<tr>
<td>Floodplains &amp; swamps (%): 0</td>
<td>Floodplains &amp; swamps (%): 0</td>
</tr>
</tbody>
</table>

East New Britain Province
Pomio District is in the south of East New Britain and covers the east Baining Mountains, the coastal plains, the inland limestone plateaux and valleys, the Nakaini Mountains and the volcanic peaks of Mt Ulawan and Mt Bamus. Average annual rainfall ranges from 2500 mm in the east Baining Mountains, to over 5000 mm on the south coast. Altitude varies from sea level to over 2000 m on Mt Ulawan and Mt Bamus.

Population
The estimated rural population in the year 2000 is 62 000. The highest population density is on the coastal plains around Pomio with 78 persons/km², while the coastal plains around Uvol have 55 persons/km². There are 23 persons/km² in the Nutuve and Leli areas, in the east Baining Mountains, on the southeast coast from Warangoi Bay to Cape Oxford, and in the Melkoi, Megigi and Torlu valleys. The Wala and Ania valleys, in the southwest of the district, have 10 persons/km².

Subsistence agriculture and nutrition
Agriculture in the east Baining Mountains and on the southeast and south coasts is dominated by low intensity mixed staple cultivation. One planting is made before a fallow period of 5–15 years. People in the Nutuve and Leli areas and in the Melkoi, Megigi and Torlu valleys cultivate low intensity sweet potato gardens, which are supplemented by taro in some places. Coconut is an important food in all coastal areas. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as serious; 56 per cent of children were stunted and four per cent were seriously under weight.

Land potential
The land potential is moderate in the east Baining Mountains and on the southeast coast, but is constrained by steep slopes and frequent cloud cover. Mt Ulawan is a hazardous active volcano. The Ania Valley has moderate potential constrained by high rainfall. The limestone plains on the south coast have low potential caused by poor soils and high rainfall, while the inland mountain areas have very low to low potential due to high rainfall, steep slopes, poor soils and frequent cloud cover.
A man harvests oil palm fruit on a settlement block. Oil palm development on the north coast between Talasea and Sade has created one of the more developed areas in the country. The population has one of the highest growth rates in PNG, largely due to the in-migration of settlers to oil palm blocks. There is a good network of surfaced and sealed roads and people earn very high incomes.

People oversee logging operations near the Aria River. There has been extensive logging in West New Britain, particularly along the south coast, in the centre of the island and between Cape Gloucester and the Willaumez Peninsula. Logging activities temporarily improve access to services and markets through road construction and provide some cash income to people through royalties and wage employment. However, the income is short-term and the roads often become unusable when maintenance stops. Unless income is invested into long-term development activities, including education, cash-cropping and small businesses, people will return to being very poor when logging ceases.
Introduction

West New Britain occupies 20,800 km² of New Britain Island in the northeast of PNG. The northeast coast, from Talasea to Sule, is dominated by plains and floodplains with fertile volcanic soils. This area has been densely settled since the early 1970s through formal settlement schemes based on oil palm production. Inland of the coastal plains are the volcanic peaks of Mt Ulawun, Mt Bamus and Mt Galloeseulo. The Williamstown Peninsula has fertile valleys and many volcanic peaks, of which a number are still active. West of Talasea are extensive coastal plains and a number of prominent mountains including the active volcanic peaks around Cape Gloucester. The interior of the province is dominated by the Nakanai Mountains and the Whiteman Range with coastal plains and valleys along the south coast. The Bali Witu Island group is 160 km northwest of Kimbe in the Bismarck Sea, while Lolobau Island is eight km off the coast from Sule. Altitude varies from sea level to over 2000 m on Mt Ulawun and Mt Bamus. Average annual rainfall varies from 3500 mm at Cape Gloucester, to over 5000 mm on the south coast. Most occupied areas of the province receive over 4000 mm of rain per year. The two districts in West New Britain are Kandrian-Gloucester and Talasea.
The estimated rural population of West New Britain in the year 2000 is 99,000, which is 2.5 per cent of the national rural population. The provincial rural population growth rate is high at 3.3 per cent per annum. The highest population densities are on the Bali Witu Islands where there are 220 persons/km² and the Arawe Islands which have 200 persons/km². The northeast coastal plains, from Kimbe to Bialla, have 130 persons/km², while the Talasea area has a density of 50 persons/km². The north coast plains, west of Talasea, the south coast plains and the Cape Gloucester area have an average density of 30 persons/km², while the inland areas have 5 persons/km². The northeast coastal plains from Kimbe to Bialla have significant in-migration of people to the various settlement schemes, mainly from East Sepik, Simbu and East New Britain provinces.
The northeast coastal plains from Talasea to Sule have an extensive network of good roads that service the oil palm settlement schemes. Much of the New Britain Highway is sealed. A gravel road crosses the island from Hoskins to Amio and a road of lesser quality extends south from Sule into the inland. There are numerous logging roads in the south coast valleys, inland of Kandrian, and around Cape Gloucester. These roads, and in particular the bridges, are short-term constructions that deteriorate when maintenance stops. Outboard motor boat and canoe travel are common in coastal areas. People on the coastal plains between Talasea and Bialla require less than four hours’ travel to reach the nearest service centre, while those in most other parts of the province require 4–8 hours’ travel. People in the Nakanai Mountains are very remote and require more than one day’s travel to reach the nearest service centre.

Access to services

The northeast coastal plains from Talasea to Sule have an extensive network of good roads that service the oil palm settlement schemes. Much of the New Britain Highway is sealed. A gravel road crosses the island from Hoskins to Amio and a road of lesser quality extends south from Sule into the inland. There are numerous logging roads in the south coast valleys, inland of Kandrian, and around Cape Gloucester. These roads, and in particular the bridges, are short-term constructions that deteriorate when maintenance stops. Outboard motor boat and canoe travel are common in coastal areas. People on the coastal plains between Talasea and Bialla require less than four hours’ travel to reach the nearest service centre, while those in most other parts of the province require 4–8 hours’ travel. People in the Nakanai Mountains are very remote and require more than one day’s travel to reach the nearest service centre.
People on the northeast coast have high to very high incomes derived from oil palm production and supplemented by income from the sale of fresh food, cocoa, betel nut and copra. People in the Bali and Witu Islands earn high incomes from the sale of copra, cocoa, fish, fresh food and betel nut. All other people in the province have very low incomes derived from minor sales of fresh food, copra, cocoa, fish or tobacco. There are many sources of non-agricultural income on the northeast coast around Talasea, Kimbe and Hoskins including small businesses such as PMVs and trade stores, and wage employment opportunities provided by businesses and plantations. People on the south coast, on the northwest coast and in the interior of the island receive wages and royalties from forestry operations. There appears to be little investment of this money into other income-generating activities. Many people who received some income from logging in the past now have very limited income. It is likely that this trend will continue.
Agriculture in the Bali Witu Islands is characterised by moderate intensity mixed staple cultivation of banana, cassava, Chinese taro and sweet potato. There are two consecutive plantings before a fallow period of 1–3 years. On the northeast coastal plains and in most inland areas, people cultivate similar crops at lower intensities. Food crops are grown on the oil palm settlement blocks. Settlers on the older blocks are commonly short of land for food gardens, but people on the newer blocks grow and sell significant quantities of food. On the northwest coast, on the south coast and in the Cape Gloucester area, people cultivate low intensity sweet potato gardens, while those in the valleys inland of Kandrian make low intensity sweet potato and taro gardens. Coconut is an important food in all coastal areas.
The land potential is very high on the volcanic plains and fans around Cape Gloucester, although rainfall is high. Soils, slope and temperature are ideal for the production of many crops. However, the north side of Cape Gloucester is vulnerable to volcanic activity from Mt. Gula. The northeastern coastal plains have low to high potential limited by inundation, poor soils and high rainfall. Where land is drained, the land potential is significantly increased. The south coast around Kandrian and the Balai Wem Islands have moderate to high potential constrained by high rainfall, while the south coast around Gasmara has very low potential because of high rainfall, poor soils and frequent cloud cover. Most inland areas have low to moderate potential caused by steep slopes, high rainfall, poor soils and frequent cloud cover.
Strong agricultural pressure exists in parts of the Bali Witu and Arawe islands as a result of moderate intensity agriculture being practised in low potential environments. People in these areas are vulnerable to the effects of land degradation, declining crop yields and food shortages. The northeast coastal plains have areas of moderate pressure, while the area around Talasea has marginal pressure. There is potential for agricultural development around Cape Gloucester where land potential is very high, but there is a volcanic hazard and market access is restricted by the high cost of coastal shipping. Given the very high potential land on nearby Umbai Island and the close proximity of both areas to Lae, there is potential for large-scale agricultural development. Cocoa, bael nut, oil palm, fresh food and copra are some possible crops for further development. Existing oil palm development on the northeast coast and very high population densities limit the potential for further expansion, however, there is scope for more productive use of land within the settlement blocks.
There is a marked contrast in the environments, income and access to services between the two districts in the province, with conditions significantly better in most parts of Talasea District compared to Kandrian-Gloucester District. The most disadvantaged people in the province are the small numbers in the Gavuru and Ala valleys of the Nakanai Mountains who live in low potential environments, earn very low incomes and have poor access to services. They have few opportunities to improve their livelihoods. Small numbers of people in the Arawe Islands are constrained by strong agricultural pressure, very low incomes and very high population densities. They are vulnerable to the effects of land shortages, land degradation, declining crop yields and food shortages, and have limited cash to purchase supplementary food. Large numbers of people in the Bali Witu Islands face similar constraints but have higher incomes. In the Gasmata area and the Baru, Palicks and Andaru valleys, people live in low potential environments and earn very low incomes. Most other people in the province earn very low incomes.
Kandrian-Gloucester District is in the southwest of West New Britain and covers the northwest coastal plains, the inland valleys, the prominent peaks of Mt Andewa and Mt Schrader, and the active volcanoes around Cape Gloucester. The south of the district covers narrow coastal plains, inland valleys and extensive limestone plateaux. Average annual rainfall ranges from 3500 mm at Cape Gloucester, to over 5000 mm on the south coast. Altitude varies from sea level to over 1900 metres.

Population
The estimated rural population in the year 2000 is 36 000. The highest population density is in the Arawe Islands where there are 200 persons/km². The south coast, from Amio to the Arawe Islands, has moderate densities of 36 persons/km², while the northwest coast and Cape Gloucester area have 25 persons/km². The Aria and Gaho valleys, inland of Cape Kirchoff on the north coast, and the Alimbit, Palicks, Anduru and Awio valleys, inland of Kandrian, have low densities of 8 persons/km².

Access to services
All people in the district require 4–8 hours’ travel to reach the nearest service centre. A gravel road crosses the island from Hoskins to Amio and there are numerous poor quality logging roads in the valleys inland of Kandrian and around Cape Gloucester. Outboard motor boat and canoe travel are used in coastal areas.

Income
Incomes are very low in the entire district and are derived from minor sales of cocoa, copra, fresh food, fish and tobacco. At present, some people on the south coast, around Kandrian, and at Cape Gloucester, receive wages and royalties from forestry operations. It is most likely that incomes will decline once logging operations cease over the next decade.

Subsistence agriculture and nutrition
Agriculture in the Banu, Aria and Gaho valleys is characterised by low intensity mixed staple cultivation. There is one planting before a fallow period of 5–15 years. People in the Palicks, Anduru and Awio valleys cultivate low intensity sweet potato and taro gardens, while those on the northwest coast, in the Cape Gloucester area, on the south coast and in the inland valleys of the Magap, Aria and Alimbit rivers make low intensity sweet potato gardens. Coconut is an important food in all coastal areas. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as fair; 34 per cent of children were stunted and three per cent were seriously under weight.

Land potential
The land potential is very high on the volcanic plains and fans around Cape Gloucester, although rainfall is high and Mt Gulu presents a distinct volcanic hazard, especially towards the northwest. The south coast around Kandrian and the inland valleys of the Magap, Aria and Alimbit rivers have low to moderate potential due to high rainfall. The south coast around Gasmata and the inland valleys of the Palicks, Anduru and Awio rivers have very low to low potential caused by high rainfall, poor soils and frequent cloud cover. The northwest coast and the inland valleys of the Aria, Gaho and Banu rivers have low to moderate potential as a result of high rainfall, steep slopes and poor soils.

Agricultural pressure and potential
There is strong agricultural pressure in the Arawe Islands caused by moderate intensity agriculture being practised in a low potential environment. There is potential for agricultural development around Cape Gloucester where land potential is very high, but there is a volcanic hazard and market access is constrained by expensive coastal shipping. Given the very high potential land on nearby Umboi Island and the close proximity of both areas to Lae, there is potential for large-scale agricultural development. Cocoa, betel nut, oil palm, fresh food and copra production are some possible crops for further development.

Disadvantaged people
The most disadvantaged people in the district are the small numbers in the Arawe Islands who are constrained by strong agricultural pressure, very low incomes and very high population densities. They are vulnerable to the effects of land shortages, land degradation, declining crop yields and food shortages, and have little cash to purchase supplementary food. In the Gasmata area and in the Banu, Palicks and Anduru valleys, people live in low potential environments and earn very low incomes. Most other people in the district earn very low incomes. Overall, people in Kandrian-Gloucester District are seriously disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is moderate, access to services is poor and cash incomes are very low.
Talasea District is in the northeast of West New Britain Province, the northeast coastal plains from Talasea to Sule and numerous volcanic peaks including Mt Ulawun and Mt Bannas. The interior of the district covers the Nakai Mountains and the valleys of the Kapiura, Metelen, Awio, Iglık, Gavuvu and Ala rivers. The Bali Witu Island group is approximately 160 km northwest of Kimbe, while Lolobau Island is eight km from Sule. Average annual rainfall ranges between 4000 and 5000 mm, increasing from north to south. Altitude varies from sea level to over 2000 m on Mt Ulawun.

Population

The estimated rural population in the year 2000 is 63,000. The highest population densities are in the Bali Witu Islands where there are 220 persons/km² and on the northeast coastal plains from Hoskins to Sule where there are 130 persons/km². The Talasea area has a density of 50 persons/km², while the Gavuvu and Ala valleys have densities of 34 persons/km². The Metelen, Awio and Iglık valleys have very low densities of 4 persons/km². The northeast coastal plains have significant in-migration, mainly into the existing land settlement schemes. The population of the Bola census division increased by 6.3 per cent per annum between 1980 and 1990.

Access to services

People on the coastal plains from Talasea to Bialla require less than four hours’ travel to reach the nearest service centre. The northeast coastal plains from Talasea to Sule have an extensive network of good roads and much of the New Britain Highway is sealed. A gravel road crosses the island from Hoskins to Amio. Outboard motor boat and canoe travel are common in coastal areas.

Income

People on the northeast coast have high to very high incomes derived from the sale of oil palm, fresh food, cocoa, betel nut, fish and copra. In the Bali Witu Islands, people earn high incomes from the sale of the same products, with the exception of oil palm. People in the Kapiura, Metelen, Awio, Iglık, Gavuvu and Ala valleys earn very low incomes from minor sales of tobacco. There are many sources of non-agricultural income on the northeast coast around Talasea, Kimbe and Hoskins including small businesses such as PMVs and trade stores, and wage employment opportunities provided by businesses and plantations.

Subsistence agriculture and nutrition

Agriculture in the Bali Witu Islands is characterised by moderate intensity mixed staple cultivation, with large areas of smallholder coconut plantations. There are two consecutive staple crop plantings before a fallow period of 1–3 years. People on the northeast coastal plains and in the inland valleys cultivate similar crops but at lower intensities. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as relatively low; 32 per cent of children were stunted and two per cent were seriously under weight. However, the contrasts in living conditions between the oil palm block settlers and the local village people makes this information difficult to interpret.

Land potential

The land potential ranges from low to high on the northeast coast. Some areas are regularly flooded, have poor soils and high rainfall. Where drainage is used, the land potential increases significantly. The Bali Witu Islands have low to moderate potential due to high rainfall and steep slopes. In the inland valleys of the Nakai Mountains, land potential is low to moderate caused by high rainfall, steep slopes and frequent cloud cover.

Agricultural pressure and potential

There is strong agricultural pressure in the Bali Witu Islands, moderate pressure on the northeast coastal plains and marginal pressure around Talasea. Existing oil palm development on the northeast coast and very high population densities limit the potential for new agricultural development, but there is scope for more productive use of land within the settlement blocks.

Disadvantaged people

The most disadvantaged people in the district are the small numbers in the Gavuvu and Ala valleys of the Nakai Mountains who live in low potential environments, earn very low incomes and have poor access to services. Large numbers of people in the Bali Witu Islands are constrained by strong agricultural pressure and very high population densities. They are vulnerable to the effects of land shortages, land degradation, declining crop yields and food shortages. Overall, people in Talasea District are not disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is moderate, access to services in good and cash incomes are high.
Genetically improved cocoa seedlings in a nursery. Before the crisis, Bougainville produced about half of PNG’s annual cocoa crop through both plantation and smallholder production. Rehabilitation of the smallholder cocoa industry is now progressing with the planting of genetically improved seedlings, better management of existing cocoa trees and the introduction of solar dryers that improve returns for smallholder growers. Incomes on much of Bougainville Island are likely to rise significantly over the coming decade.

A newly constructed bridge on Bougainville Island. The extensive road network on Bougainville deteriorated during the crisis and many bridges were destroyed. Infrastructure, particularly roads and bridges, is now being rebuilt. This will improve access to services and markets for most rural people and bring many other benefits to them.

Bougainville Province
Bougainville Province consists of 9300 km² of islands in the far east of PNG and is on the border with the Solomon Islands. The province includes the main island of Bougainville and adjacent Buka Island, and a number of small offshore island groups including the Niasan, Nuguria, Takuu, Nukumanu and Tului islands. The Nukumanu Islands are 530 km east of Buka, while the Takuu and Nuguria islands are 250 km east and north of Buka respectively. Bougainville Island is dominated by the volcanic peaks of the Crown Prince Range, including the active volcano of Mt Baga. The coastal areas include raised coral limestone plains, volcanic plains and fans, valleys, floodplains and swamps. Most of the coastal areas have fertile volcanic soils that have been used extensively for plantation and smallholder cocoa and coconut production. Buka Island is a large raised coral limestone plain with the hills of the Parkinson Range in the southwest. Average annual rainfall in the province varies from 2500 mm around Tinputz, to over 4000 mm around Buin. Altitude varies from sea level to over 2000 m on Mt Balbi. During the 1990s, the civil war (or crisis) caused considerable disruption to the lives of villagers and to the provincial economy. Fighting ceased in 1996. Before the crisis, Bougainville Island was one of the most developed areas in PNG. The three districts in the province are Central Bougainville, North Bougainville and South Bougainville.
The estimated rural population of Bougainville in the year 2000 is 157,000, which is four per cent of the national rural population. The provincial rural population growth rate is 2.4 per cent per annum. These figures are estimates and may be inaccurate because the last population census in Bougainville was in 1980 and many people left the province during the crisis. The highest population densities are on Matsungan, Petats, Yame, Povorai and Herara islands, off the west coast of Buka, with 300 persons/km$^2$. The Nisan, Niargia, Takua, Nukumana and Tolan islands have 150 persons/km$^2$. Buka Island and the Buin area have a density of 40 persons/km$^2$, while the east coast and south of Bougainville have an average of 30 persons/km$^2$. The northwest coast and central mountains of Bougainville have low population densities of 14 persons/km$^2$. 

![Population Map](image)
The east coast and southern interior of Bougainville Island had a good network of roads before the crisis. There was also a road along the northwest coast of Bougainville from Siara to Kuraio. However, most of the roads and bridges were not maintained during the crisis and are now in poor condition. International development organisations are presently funding road maintenance activities as part of a larger infrastructure development program in the province. Buka Island has a good network of roads. Outboard motor boat and canoe travel are used in coastal areas and between islands. People on Buka and in the north and southeast of Bougainville Island require less than four hours’ travel to reach the nearest service centre. People on the rest of Bougainville Island and in the Nissan Islands require 4–8 hours’ travel to reach the nearest service centre, while those on the Nuguria, Takuu, Nukumanu and Tulun islands are remote and require more than one day’s travel.
People on Buka and in the northeast of Bougainville Island earn high incomes from the sale of cocoa, copra, fresh food, betel nut and fish. People elsewhere on Bougainville earn low to moderate incomes from the sale of cocoa, copra, fresh food, betel nut and fish. As new cocoa plantings come into production, and existing plantings are restored, incomes should become very high on most of Bougainville. People in the Niusan Islands earn low incomes from the sale of fish and copra, while those in the Ngurara, Takuru, Nakumanu and Tulun islands have very low incomes derived from minor sales of fish and copra. There are presently few non-agricultural sources of income in the province. However, Bougainville is rich in resources and there is potential for income to be derived from royalties, wage employment and business opportunities associated with mining, forestry and plantation operations.
Agriculture on Buka and on most of Bougainville is characterised by moderate intensity sweet potato production. There are 3–5 consecutive plantings before a fallow period of 5–15 years. People on the southeast coast of Bougainville and in the Nissan Islands cultivate low intensity sweet potato gardens. In the Nuguria, Takuu, Nakumatu and Tulun islands, agriculture is characterised by permanent stands of coconut and swamp taro, and the high intensity cultivation of cassava and sweet potato. In these islands, cultivation is continuous and production is supported by mulching and mounding. On the small islands west of Buka Island, people make high intensity sweet potato gardens. Coconut is an important food in all areas of the province.
The land potential is very high on the east coast of Buka Island and on the northeast coast of Bougainville Island, and is among the highest in PNG. Rainfall, soils, slope, light and temperature are ideal for the production of many tropical crops. There is high land potential in the Parkinson Range on Buka, on the southeast and northwest coasts of Bougainville Island and on Taof Island. The central plains on Buka have moderate potential limited by frequent cloud cover, while the inland valleys in the north of Bougainville Island have moderate potential due to steep slopes and frequent cloud cover. The inland valleys in the south of Bougainville Island have moderate potential limited by high rainfall and frequent cloud cover, while the coastal floodplains in the southwest have low potential constrained by high rainfall, poor soils and frequent inundation. The offshore islands have moderate potential constrained by poor soils.
There is very strong agricultural pressure in the Nuguria, Takuu, Nukumanu and Tului islands resulting from very high intensity agriculture being practised in moderate potential environments. People in these areas are vulnerable to the effects of land degradation, declining crop yields and food shortages. Moderate agricultural pressure exists in the centre of Buka Island, in the northern and western valleys and on the southwestern plains of Bougainville Island. There are areas of marginal pressure in the Niuau Islands and on the southern plains of Bougainville Island which will be of concern in the future if agriculture continues to intensify without the adoption of suitable management practices. There is good potential for agricultural development on the east coast of Buka Island and on the northeast coast of Bougainville Island, where there is very high land potential and good access to markets. Cocoa, copra, fresh food and betel nut production are established smallholder cash-earning activities in these areas. The areas of moderate and high land potential on Bougainville are also suitable for agricultural development.
The most disadvantaged people in the province are those on the Nuguria, Takuu, Nukumanu and Tulin islands where very small numbers of people are constrained by very high population densities, very strong agricultural pressure, very low incomes and poor access to services. People in these areas are vulnerable to the effects of land shortages, land degradation, declining crop yields and food shortages, and have limited money to purchase supplementary food. They are among the most disadvantaged people in PNG.

Large numbers of people on central Buka Island, in the northern and western valleys and on the southwestern plains of Bougainville Island are affected by moderate agricultural pressure.
Central Bougainville District is located along the central east coast of Bougainville Island. The district covers the inland mountains of the Crown Prince Range, the eastern coastal plains from Cape Nehus to Lalaui Point, and the inland valleys of the Lalaui, Aropa, Pinet, Arakauw, Vito and Wakanui rivers. Average annual rainfall ranges from 2700 mm near Wakanui, to 3300 mm in the Lalaui Valley on the southeast coast. Altitude varies from sea level to over 2200 m on Mt Takaka.

Population

The estimated rural population in the year 2000 is 45 000. The highest population densities of 30 persons/km² are in the southern mountains of the Crown Prince Range, the inland valleys of the Lalaui, Aropa, Pinet, Arakauw and Vito rivers and on the coastal plains south of Cape Mabiri. The coastal plains north of Cape Mabiri and the Wakanui Valley have a density of 24 persons/km², while the northern mountains of the Crown Prince Range have 14 persons/km².

Access to services

The coastal areas of the district have a good network of roads and maintenance has improved over the past few years. There is a road inland to the Panguna mine site, which continues to the west coast. Outboard motor boat and canoe travel are used in coastal areas. People in the inland valleys of the Lalaui, Aropa, Pinet, Arakauw and Vito rivers and on the coastal plains south of Cape Mabiri require less than four hours’ travel to reach Arawa. People in the Crown Prince Range, the Wakanui Valley and the coastal plains north of Cape Mabiri require 4–8 hours’ travel to reach the nearest service centre.

Income

Incomes are high in the Wakanui Valley and on the coastal plains north of Cape Mabiri, and are derived from the sale of cocoa, copra, fresh food, betel nut and fish. People in the Crown Prince Range earn moderate incomes from similar activities, while people in the remainder of the district earn low incomes. As cocoa comes back into production, incomes should again become very high in most parts of the district. There are presently few non-agricultural sources of income in the district. However, the area is rich in resources and there is potential for income to be derived from royalties, wage employment and business opportunities associated with mining, forestry and plantation operations. Wage employment around Arawa and Kieta should also increase over time.

Subsistence agriculture and nutrition

Sweet potato is the most important staple crop in the district. People in the Crown Prince Range, the Wakanui Valley and on the coastal plains north of Cape Mabiri cultivate moderate intensity gardens. In these areas 3–5 consecutive plantings are made before a fallow period of 5–15 years. People in the inland valleys and on the coastal plains south of Cape Mabiri plant low intensity sweet potato gardens. Coconut is an important food in all areas of the district. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as fair; 38 per cent of children were stunted and two per cent were seriously under weight.

Land potential

The land potential is very high on the volcanic plains and fans between Cape Nehus and Manetari. The land here is among the most productive in PNG. There is high land potential constrained by steep slopes in the inland valleys of the Lalaui, Aropa, Pinet, Arakauw, Vito and Wakanui rivers. The Crown Prince Range has low to moderate potential due to frequent cloud cover and steep slopes, while the coastal floodplains have low to moderate potential caused by poor soils and frequent inundation.

Agricultural pressure and potential

There are areas of marginal agricultural pressure in the Crown Prince Range which will be of more concern in the future if agriculture continues to intensify without the adoption of suitable management practices. There is potential for agricultural development on the volcanic plains and fans between Cape Nehus and Manetari, where there is very high land potential and good access to markets. The areas of high and moderate land potential in the inland valleys are also well-suited to agricultural development. In this area, cocoa, copra, fresh food and betel nut are established cash crops, but other crops may have economic potential.

Disadvantaged people

There are few disadvantaged people in the district according to the criteria used in this handbook. Overall, people in Central Bougainville District are slightly disadvantaged relative to people in other districts of PNG. There is little agricultural pressure, land potential is high, access to services is good and incomes are low.
North Bougainville District includes Buka Island and the northern third of Bougainville Island. The Nissan, Nuguria, Takuu, Nukumanu and Tulun islands are also part of the district. Most of these small islands are raised coral limestone plains. Average annual rainfall ranges from 2600 to 3300 millimetres. Altitude varies from sea level to over 2700 m on Mt Balbi.

Population
The estimated rural population in the year 2000 is 57,000. The highest population densities are found on the small islands off the west coast of Buka Island where there are 300 persons/km². The density on the Nissan, Nuguria, Takuu, Nukumanu and Tulun islands is 150 persons/km². Buka Island and the north coast of Bougainville Island have densities of 40 persons/km², while the northeast coast of Bougainville Island has 25 persons/km². The plains and valleys on the west coast of Bougainville have low densities of 14 persons/km².

Access to services
Buka Island and the northeast coast of Bougainville Island have a good network of roads and there is a road of lesser quality along the west coast from Siara to Kuraisi. Roads are being improved following a lack of maintenance during the crisis. Outboard motor boat and canoe travel are used in coastal areas and to travel between islands. People on Buka and on the north coast of Bougainville require less than four hours’ travel to reach Buka town. People on the west and east coasts of Bougainville and in the Nissan Islands require 4–8 hours’ travel to reach Buka town, while those in the Nuguria, Takuu, Nukumanu and Tulun islands are remote and require more than one day’s travel.

Income
Incomes are high on Buka and on the northeast coast of Bougainville and are derived from the sale of cocoa, copra, fresh food, betel nut and fish. People on the west coast of Bougainville earn moderate incomes from the same activities. As cocoa comes back into production, incomes should become very high on most of Bougainville. People in the Nissan Islands have low incomes, while those in the Nuguria, Takuu, Nukumanu and Tulun islands have very low incomes derived from minor sales of fish and copra.

Subsistence agriculture and nutrition
Agriculture on Buka and on most of Bougainville is characterised by moderate intensity sweet potato production. There are 3–5 consecutive plantings before a fallow period of 5–15 years. People in the Nissan Islands cultivate low intensity sweet potato gardens, while those on the small islands west of Buka make high intensity sweet potato gardens. On the Nuguria, Takuu, Nukumanu and Tulun islands, agriculture is characterised by permanent stands of coconut and swamp taro, and high intensity cultivation of casava and sweet potato. Coconut is an important food in all areas of the district. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as fair; 28 per cent of children were stunted and seven per cent were seriously underweight.

Land potential
The land potential is very high on the east coast of Buka and on the northeast coast of Bougainville. There is high land potential in the Parkinson Range on Buka, on the northwest coast of Bougainville and on Taiof Island. The central plains of Buka Island have moderate potential limited by frequent cloud cover, and the northern inland valleys of Bougainville Island have moderate potential due to steep slopes and frequent cloud cover. The offshore islands have moderate potential constrained by poor soils.

Agricultural pressure and potential
There is very strong agricultural pressure in the Nuguria, Takuu, Nukumanu and Tulun islands. There is moderate pressure in central Buka Island and in the northern valleys of Bougainville Island, and there is marginal pressure in the Nissan Islands. There is potential for agricultural development on the east coast of Buka and on the northeast coast of Bougainville, where there is very high land potential and good access to markets. The areas of moderate and high land potential on Buka and Bougainville islands are also well-suited to agricultural development. Cocoa, copra, fresh food and betel nut are established cash crops, but other crops may have economic potential.

Disadvantaged people
The most disadvantaged people in the district are the very small numbers in the Nuguria, Takuu, Nukumanu and Tulun islands who are constrained by very high population densities, very strong agricultural pressure, very low incomes and poor access to services. They are vulnerable to the effects of land shortages, land degradation, declining crop yields and food shortages, and have limited money to purchase supplementary food. These people are among the most disadvantaged people in PNG. Overall, people in North Bougainville District are not disadvantaged relative to people in other districts of PNG. There is some agricultural pressure, land potential is very high, access to services is good and cash incomes are high.
South Bougainville District covers the southern end of Bougainville Island. It includes the inland mountains and valleys of the Crown Prince Range, the extensive volcanic fans around Mt Taraka, the Deuro Range and the coastal floodplains and swamps, from Laranuma Point on the west coast to Lalai Point on the southeast coast. Average annual rainfall ranges from 3200 mm near Torokina, to over 4000 mm on the volcanic fans around Boku and Buin. Altitude varies from sea level to over 2200 m on Mt Takaka. The border with the Solomon Islands is 10 km southeast of Tonoilei Harbour.

Population
The estimated rural population in the year 2000 is 55,000. The highest population densities of 35 persons/km² are found on the volcanic fans, the Deuro Range, the hills around Tonoilei Harbour and isolated settlements on the south coast. The Crown Prince Range and the Torokina and Laranuma valleys on the west coast, have a density of 14 persons/km².

Access to services
The southernmost part of the district has a good network of roads and maintenance has improved over the past few years. Roads extend to the south coast at Paruparau, Tokuag, Mosigo, Atuara and Marau. Outboard motor boat and canoe travel are common in coastal areas. All people in the district require 4–8 hours’ travel to reach Arawa.

Income
Incomes are moderate in the entire district and are derived from the sale of cocoa and fresh food. New cocoa plantings come into production, and old plantations are restored, incomes should become high to very high on the volcanic fans. There are presently few non-agricultural sources of income in the district. However, the area is rich in resources and there is potential for income to be derived from royalties, wage employment and business opportunities associated with mining, forestry and plantation operations.

Subsistence agriculture and nutrition
Agriculture in the west of the district is characterised by moderate intensity sweet potato production, where 3–5 consecutive plantings are made before a fallow period of 5–15 years. In the upper Aiba and Piria valleys, near Oria, people cultivate low intensity sweet potato gardens. Coconut is an important food in all areas of the district. In the 1982–83 National Nutrition Survey, malnutrition in children under five years was assessed as fair; 31 per cent of children were stunted and six per cent were seriously under weight.

Land potential
The land potential is very high in the upper Abia and Piria valleys, east of Oria, but is constrained by high rainfall. There is high land potential in the inland valleys of the Crown Prince Range limited by steep slopes. The volcanic fans have moderate potential constrained by frequent cloud cover and high rainfall, while the Deuro Range has moderate potential due to steep slopes and high rainfall. The coastal plains have very low to low potential caused by high rainfall, poor soils, frequent flooding and excessive cloud cover.

Agricultural pressure and potential
Areas of marginal and moderate agricultural pressure occur throughout the district. There is potential for agricultural development in the upper Aiba and Piria valleys, east of Oria, where there is very high land potential and good access to markets. The areas of moderate and high land potential in the inland valleys of the Crown Prince Range and on the volcanic fans are also well-suited to agricultural development. Road access to the inland valleys in the north of the district will need to be improved to realise the full potential of the area. Cocoa and fresh food production are established smallholder cash-earning activities.

Disadvantaged people
The most disadvantaged people in the district are the large numbers on the southwestern volcanic plains and fans who are constrained by moderate agricultural pressure. Overall, people in South Bougainville District are moderately disadvantaged relative to people in other districts in PNG. There is some agricultural pressure, land potential is moderate, access to services is moderate and cash incomes are moderate.
National Overview

Tobacco leaves dry on the wall of a house. Tobacco is commonly grown in PNG for home use and sale in local markets. It is sometimes traded over long distances. Tobacco is grown in all regions of the country, but is more commonly found in inland locations between altitudes of 400 and 1200 metres.

Betel nut palms. Betel nut is widely grown in lowland PNG and a related species is grown in several highland areas. It is an important source of cash income in areas with good road or river access to Port Moresby and the Highlands Highway, as well as areas near major urban centres such as Kokopo and Madang. Over the past decade, there have been extensive new plantings of betel nut in many areas as demand continues to grow.
Approximately 25 per cent of rural land is occupied by semi-subsistence farmers, while the remaining 75 per cent is unoccupied. Most occupied land has low population densities.

The highest population densities are in the central highland valleys, some lowland areas, and on a number of small islands.

Population densities are increasing in many areas due to high fertility rates, significant in-migration, and little expansion of occupied land.

### Population density

<table>
<thead>
<tr>
<th>Population density</th>
<th>Estimated year 2000 rural population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (1–20 persons/km²)</td>
<td>736,800</td>
</tr>
<tr>
<td>Moderate (21–60 persons/km²)</td>
<td>1,479,400</td>
</tr>
<tr>
<td>High (61–100 persons/km²)</td>
<td>812,600</td>
</tr>
<tr>
<td>Very high (101–600 persons/km²)</td>
<td>1,003,800</td>
</tr>
</tbody>
</table>
People with the worst access to services live in the fringe areas of the highlands, in much of Sandaun Province, in inland eastern Papua and in the interior of New Britain.

People living in the highland valleys and near major towns generally have good access to services.

### Access to services

<table>
<thead>
<tr>
<th>Access to services</th>
<th>Estimated year 2000 rural population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very poor (&gt;1 day's travel to a service centre)</td>
<td>143,800</td>
</tr>
<tr>
<td>Poor (4–8 hrs travel to a minor service centre)</td>
<td>508,700</td>
</tr>
<tr>
<td>Moderate (4–8 hrs travel to a major service centre)</td>
<td>1,496,900</td>
</tr>
<tr>
<td>Good (1–4 hrs travel to a major service centre)</td>
<td>1,578,000</td>
</tr>
<tr>
<td>Very good (&lt;1 hrs travel to a major regional centre)</td>
<td>305,200</td>
</tr>
</tbody>
</table>
Over 50 per cent of the rural population earn very low to low incomes.

People with high to very high incomes generally sell some combination of oil palm, coffee, fresh food, cocoa, betel nut and coconuts. The contribution of mining and forestry operations to household incomes is significant in some places, but only a limited number of people benefit.

### Income

- **Very low income (0–20 kina/person/year)**
- **Low income (21–40 kina/person/year)**
- **Moderate income (41–100 kina/person/year)**
- **High income (101–200 kina/person/year)**
- **Very high income (>200 kina/person/year)**

### Estimated Year 2000 rural population

<table>
<thead>
<tr>
<th>Income</th>
<th>Estimated Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low (0–20 kina/person/year)</td>
<td>1,244,000</td>
</tr>
<tr>
<td>Low (21–40 kina/person/year)</td>
<td>769,000</td>
</tr>
<tr>
<td>Moderate (41–100 kina/person/year)</td>
<td>824,200</td>
</tr>
<tr>
<td>High (101–200 kina/person/year)</td>
<td>746,600</td>
</tr>
<tr>
<td>Very high (&gt;200 kina/person/year)</td>
<td>268,800</td>
</tr>
</tbody>
</table>
Subsistence agriculture

Over 50 per cent of the rural population practice low intensity agriculture, defined here as where land is cropped for up to a quarter of the entire cultivation cycle (sum of the cropping and fallow periods). Intensity increases when the number of plantings increase or the length of the fallow period shortens.

This map is different from the provincial maps as there are too many staple crop classes to present at the national level. The table of staple crops clearly shows the importance of sweet potato, which is the single dominant staple for over two million rural people.

### Staple crop

<table>
<thead>
<tr>
<th>Staple crop</th>
<th>Est. 2000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed staples</td>
<td>352 300</td>
</tr>
<tr>
<td>Banana</td>
<td>273 900</td>
</tr>
<tr>
<td>Banana/cassava</td>
<td>4300</td>
</tr>
<tr>
<td>Banana/Chinese taro</td>
<td>7200</td>
</tr>
<tr>
<td>Banana/sago</td>
<td>8200</td>
</tr>
<tr>
<td>Banana/sweet potato</td>
<td>88 300</td>
</tr>
<tr>
<td>Banana/yam</td>
<td>16 300</td>
</tr>
<tr>
<td>Cassava</td>
<td>8700</td>
</tr>
<tr>
<td>Cassava/Chinese taro</td>
<td>7900</td>
</tr>
<tr>
<td>Cassava/sweet potato</td>
<td>26 700</td>
</tr>
<tr>
<td>Chinese taro</td>
<td>48 100</td>
</tr>
<tr>
<td>Chinese taro/sweet potato</td>
<td>35 300</td>
</tr>
<tr>
<td>Chinese taro/taro</td>
<td>16 800</td>
</tr>
<tr>
<td>Coconut with mixed staples</td>
<td>1800</td>
</tr>
<tr>
<td>Coconut with swamp taro</td>
<td>2300</td>
</tr>
<tr>
<td>Sago</td>
<td>428 100</td>
</tr>
<tr>
<td>Sago with sweet potato</td>
<td>19 800</td>
</tr>
<tr>
<td>Sago with yam</td>
<td>400</td>
</tr>
<tr>
<td>Sweet potato</td>
<td>2 270 200</td>
</tr>
<tr>
<td>Sweet potato/taro</td>
<td>158 600</td>
</tr>
<tr>
<td>Sweet potato/yam</td>
<td>48 500</td>
</tr>
<tr>
<td>Taro</td>
<td>17 700</td>
</tr>
<tr>
<td>Taro/yam</td>
<td>71 900</td>
</tr>
<tr>
<td>Yam</td>
<td>119 400</td>
</tr>
</tbody>
</table>

### Agricultural intensity

<table>
<thead>
<tr>
<th>Agricultural intensity</th>
<th>Est. 2000 pop.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (R-values of 1–27)</td>
<td>2 312 700</td>
</tr>
<tr>
<td>Moderate (R-values of 28–50)</td>
<td>902 400</td>
</tr>
<tr>
<td>High (R-values of 51–100)</td>
<td>817 600</td>
</tr>
</tbody>
</table>
Most of the unoccupied land in the country has very low to low land potential. Approximately 40 per cent of the rural population live in environments with very low to low land potential. These people are constrained by some combination of poor soil, high rainfall, steep slopes, excessive cloud cover, frequent flooding, and low temperatures.

Approximately 35 per cent of the rural population live in environments with high to very high land potential. People in these areas often improve their land through practices such as drainage, composting, mounding and legume rotation.

<table>
<thead>
<tr>
<th>Land potential</th>
<th>Estimated year 2000 rural population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low</td>
<td>188 800</td>
</tr>
<tr>
<td>Low</td>
<td>1 404 100</td>
</tr>
<tr>
<td>Moderate</td>
<td>1 072 000</td>
</tr>
<tr>
<td>High</td>
<td>442 800</td>
</tr>
<tr>
<td>Very high</td>
<td>922 200</td>
</tr>
</tbody>
</table>
Approximately 25 per cent of the rural population, most of whom live in the highlands, are vulnerable to the effects of agricultural pressure. Examples include land degradation, declining crop yields and subsistence food shortages.

There are a number of areas that have high potential for further agricultural development, but this depends on the availability of relevant information, suitable marketing arrangements and reliable transport. Strong environmental contrasts over short distances often create potential for marketing local produce such as fresh food and fruit.

### Agricultural pressure and potential

<table>
<thead>
<tr>
<th>Agricultural pressure and potential</th>
<th>Estimated year 2000 rural population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very strong agricultural pressure</td>
<td>2300</td>
</tr>
<tr>
<td>Strong agricultural pressure</td>
<td>265,900</td>
</tr>
<tr>
<td>Moderate agricultural pressure</td>
<td>499,700</td>
</tr>
<tr>
<td>Marginal agricultural pressure</td>
<td>337,200</td>
</tr>
<tr>
<td>High agricultural potential</td>
<td>921,700</td>
</tr>
<tr>
<td>Very high agricultural potential</td>
<td>unoccupied</td>
</tr>
<tr>
<td>Occupied land</td>
<td></td>
</tr>
<tr>
<td>Unoccupied land</td>
<td>2,000,800</td>
</tr>
</tbody>
</table>

Inset 1
The most disadvantaged people in the country live in the fringe areas of the highlands, in most of Sandaun province, in the interior of New Britain and on a number of small islands in Bougainville Province.

This map is a summary of the 14 classes presented in the provincial maps. The four classes represent various combinations of constraints such as low potential environment, strong agricultural pressure, very low income and poor access to services.
District Comparisons

Men sell fresh food at a market near Tari. This market near Tari in Southern Highlands Province is unusual because women are generally the main sellers of fresh food at local markets. Sales of fresh food, both traditional and introduced types, provided cash incomes to more rural Papua New Guineans in the mid 1990s (over three million people) than any other single source. The total value of fresh food sales is exceeded only by oil palm and Arabica coffee.

A vegetable garden in Enga Province. Fresh vegetables are grown at high altitude locations in Enga Province. The vegetables are intended for distant markets, in regional centres such as Mt Hagen, Goroka, Port Moresby and Lae. There is considerable scope for expansion of fresh food marketing in PNG.
Background

The final chapter of this handbook summarises the detail presented in the district summaries from a sub-district level to a district level. This creates a framework for comparing districts that can be used by international donors and all levels of government within PNG to better target the distribution of resources. Five of the parameters described in the handbook are first ranked individually from worst to best. These attributes are then combined to create a ‘disadvantage index’, which is used to rank districts from most disadvantaged to least disadvantaged. This is not the first attempt to identify disadvantaged districts or areas in PNG. During the mid to late 1970s, the PNG National Planning Office based their Public Expenditure Plan in part on the identification of ‘less developed areas’ (National Planning Office, 1980). One outcome of this analysis was the funding of integrated rural development projects in many of the identified areas. More recently, the 1998 Human Development Report presented a provincial level ‘human development index’ based on factors such as life expectancy, education and living standards (McKay et al., 1999).

The two most comprehensive studies of disadvantaged districts were published by Wilson (1974) and de Albuquerque and D’Sa (1986). Wilson used six indicators to identify the level of socio-economic development for each sub-district. The indicators were smallholder cash crop production, hospital beds per 1000 people, administration staff per 1000 people, enrolments at primary and secondary schools per 1000 people, accessibility to the district headquarters, and the level of local government services. The second study by de Albuquerque and D’Sa used complex statistical analyses to identify ‘least developed’ districts based on measures of population density, sex ratios, dependency ratios, urbanisation, internal migration, employment, cash income, education, health and accessibility. Neither of these studies considered environmental quality or land potential, which is an important factor in determining where and how rural people live. They were also based on the pre-1995 Organic Law district boundaries that are no longer in use.

The classification of disadvantaged districts incorporates a balance of environmental, social and economic data, to better reflect the factors that create disparities between rural people. Ideally, this classification should use the same socio-economic parameters as the previous studies, to foster an understanding of how specific conditions are changing over time. However, most of the data used in the previous studies is no longer available in a consistent form for all provinces. The handbook uses the following five parameters to classify disadvantaged districts.

- Land potential
- Agricultural pressure
- Access to services
- Income from agriculture
- Child malnutrition

These parameters were identified through a number of collaborative workshops with researchers from the National Agricultural Research Institute in Lae. Details on how these parameters were derived are presented in Chapter 2 (pages 19–24).

The classification method used to derive the disadvantage index is relatively simple and transparent. It is designed to allow users to track back through the classification stages to see how the final values were generated. First, all census points and population values from the 1980 National Population Census were digitised. These census points were then allocated to the combined MASP/PNGRIS mapping unit used in the handbook, so that each mapping unit had a 1980 population. This was then updated to an estimated population for the year 2000 based on the growth rate derived from differences between the 1980 and 1990 census figures.

Each parameter was then classified into the same five classes used in the provincial maps (see Table 1). Income from agriculture, for example, was classified into a range that represents very low, low, moderate, high and very high income. These classes were assigned a working value of one to five, where a value of one was the worst, or most constraining, and a value of five was the best, or least constraining.

With the classification structure in place, the estimated populations for the year 2000 were summed for each class of each parameter in every district. This process spread the rural population of each district over the classes of each parameter. In some cases, the entire district population fell into one class, while in other cases the district population was spread over all five classes. From this, the most representative class for each parameter was derived based on the distribution of the population. Many techniques could be used to identify the most representative class. In this case, the location of the median person was used, and the working value from the identified class progressed to the final stage.
of the classification. The median person was defined as the mid-point of the total district population. Table 2 demonstrates this process. It is important to note that data resolution was lost at this point due to the process of smoothing or generalising. The child malnutrition data was already summarised to the district level, as explained in Chapter 2 and seen in Appendix 2a and 2b.

In the final stage of the classification, the five working values were added together to produce the disadvantage index for each district. The lowest total reflects the most disadvantaged district, while the highest total reflects the least disadvantaged district. Table 3 provides a worked example of this process. The final values were classified into five relatively even classes that represent districts that

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Working value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land potential</td>
<td>Very low 1</td>
</tr>
<tr>
<td></td>
<td>Low 2</td>
</tr>
<tr>
<td></td>
<td>Moderate 3</td>
</tr>
<tr>
<td></td>
<td>High 4</td>
</tr>
<tr>
<td></td>
<td>Very high 5</td>
</tr>
<tr>
<td>Agricultural pressure</td>
<td>Very strong pressure 1</td>
</tr>
<tr>
<td></td>
<td>Strong pressure 2</td>
</tr>
<tr>
<td></td>
<td>Moderate pressure 3</td>
</tr>
<tr>
<td></td>
<td>Marginal pressure 4</td>
</tr>
<tr>
<td></td>
<td>No pressure 5</td>
</tr>
<tr>
<td>Access to services</td>
<td>Very poor access 1</td>
</tr>
<tr>
<td></td>
<td>Poor access 2</td>
</tr>
<tr>
<td></td>
<td>Moderate access 3</td>
</tr>
<tr>
<td></td>
<td>Good access 4</td>
</tr>
<tr>
<td></td>
<td>Very good access 5</td>
</tr>
<tr>
<td>Income</td>
<td>Very low 1</td>
</tr>
<tr>
<td></td>
<td>Low 2</td>
</tr>
<tr>
<td></td>
<td>Moderate 3</td>
</tr>
<tr>
<td></td>
<td>High 4</td>
</tr>
<tr>
<td></td>
<td>Very high 5</td>
</tr>
<tr>
<td>Child malnutrition</td>
<td>Very serious 1</td>
</tr>
<tr>
<td></td>
<td>Serious 2</td>
</tr>
<tr>
<td></td>
<td>Poor 3</td>
</tr>
<tr>
<td></td>
<td>Fair 4</td>
</tr>
<tr>
<td></td>
<td>Relatively low 5</td>
</tr>
</tbody>
</table>

Table 2: Examples of the method used to identify the most representative income class for each district, based on the location of the mid-point of the total population, or the median person. While these examples are for income, the most representative classes for land potential, agricultural pressure and access to services were defined in the same way.

<table>
<thead>
<tr>
<th>Income class</th>
<th>Very low</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>Very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working value</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Population</td>
<td>2077</td>
<td>2174</td>
<td>10295</td>
<td>1456</td>
<td>4086</td>
</tr>
</tbody>
</table>

The total population of Lufa District is 39,088 and the mid-point of this population, or the median person, is 19,544. This person is located in the low class, which has a working value of 2. Therefore, the low class best represents income levels in this district and the working value of 2 is used to generate the disadvantage index.

<table>
<thead>
<tr>
<th>Income class</th>
<th>Very low</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>Very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working value</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Population</td>
<td>9950</td>
<td>7794</td>
<td>60,086</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The total population of Wabag District is 77,790 and the mid-point of this population, or the median person, is 38,895. This person is located in the low class, which has a working value of 2. Therefore, the low class best represents income levels in this district and the working value of 2 is used to generate the disadvantage index.

<table>
<thead>
<tr>
<th>Income class</th>
<th>Very low</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>Very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working value</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Population</td>
<td>1309</td>
<td>1891</td>
<td>45,932</td>
<td>37,814</td>
<td></td>
</tr>
</tbody>
</table>

The total population of Talasea District is 86,946 and the mid-point of this population, or the median person, is 43,473. This person is located in the high class, which has a working value of 4. Therefore, the high class best represents income levels in this district and the working value of 4 is used to generate the disadvantage index.

<table>
<thead>
<tr>
<th>Income class</th>
<th>Very low</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>Very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working value</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Population</td>
<td>1309</td>
<td>1891</td>
<td>45,932</td>
<td>37,814</td>
<td></td>
</tr>
</tbody>
</table>
are extremely disadvantaged (index values of 11-13), seriously disadvantaged (index values of 14-15), moderately disadvantaged (index values of 16-17), slightly disadvantaged (index values of 18-19) and not disadvantaged (index values of 20-25). These are the classes that are referred to in the final paragraph of each district summary.

The input parameters

Tables 4-8 present a comparison of district working values for land potential, agricultural pressure, access to services, income from agriculture and child malnutrition. A value of one is the worst or most constraining, while a value of five is the best or least constraining. Refer to Appendices 3a-3b on the digital version of this handbook at http://rspas.anu.edu.au/lmp/ for the estimated 2000 population of each class.

The disadvantage index

The disadvantage index values range from 11 to 25. It is important to note that while some districts have the same value, the combination of working values can be different. Table 9 presents the 85 rural districts, sorted from the most disadvantaged to the least disadvantaged. Each input parameter is included to illustrate how each district total was derived.

The least disadvantaged district in the country is Gazelle in East New Britain Province. The 17 districts in the ‘not disadvantaged’ class contain 910 000 people or 23 per cent of the national rural population. There is a clear geographic pattern associated with these districts. Eight are located in the fertile valleys of Western Highlands Province and adjacent areas in Enga and Simbu provinces; three are located in the fertile valleys of Eastern Highlands Province; and three are located in the fertile northeast lowlands of the Gazelle Peninsula in East New Britain Province.

At the opposite end of the scale, the two most disadvantaged districts in PNG are Middle Ramu in Madang Province and Telefomin in Sandaun Province. The 13 districts in the ‘extremely disadvantaged’ class contain 606 000 people or 15 per cent of the national rural population. The location of these 13 districts also has a clear geographic pattern. Six are in fringe areas of the central highlands and five are in inland areas of the lowlands. Another clear pattern associated with these districts is their location adjacent to provincial borders, particularly in the area around Morobe, Madang, East Sepik, Sandaun, Western, Southern Highlands, Enga and Gulf provinces. People in these border areas are commonly neglected by all provincial administrations.

Of the 20 most disadvantaged districts identified here, 17 were identified by the studies of either Wilson (1974) or de Albuquerque and DSa (1986), and 12 districts were identified by all three studies (see Table 10). These are Middle Ramu, Telefomin, Pomio, Finschhafen, Koreba-Lake Kipiago, Lagais-Pongera, Menyamya, Nipa-Kunabu, North Fly, Rai Coast, Goli and Vasia-Green River.

The strong correlation between these three independent studies is notable, particularly because they were conducted at different times over a period of 25 years using different assumptions, data and methods. Moreover, the correlation suggests that there are chronic problems in these districts as the living standards of people are not improving relative to people in other districts. This is most likely due to the two fundamental constraints of low potential environments and poor access to services and markets. These constraints inhibit the ability of people to raise household incomes. Low education levels and remoteness also mean that the communities remain marginalised and unable to exert effective influence on political and administrative processes.

Table 3: Examples of the method used to derive the disadvantage index for each district, based on the addition of the five working values. In the case of Telefomin District, the index value is 11 (2+5+1+1+2 = 11).

<table>
<thead>
<tr>
<th>District</th>
<th>Land potential</th>
<th>Agricultural pressure</th>
<th>Access to services</th>
<th>Income</th>
<th>Child malnutrition</th>
<th>Disadvantage index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telefomin</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Kandep</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Bogia</td>
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<td>5</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>Talasea</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Gazelle</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>
### Table 4: Ranking of districts, from worst to best, based on land potential working values.

These values reflect the land potential class that is most representative of the district population. A value of 2 represents low land potential; a value of 3 represents moderate land potential; a value of 4 represents high land potential; and a value of 5 represents very high land potential. Refer to page 23 for more details.

<table>
<thead>
<tr>
<th>District name</th>
<th>Land potential</th>
<th>District name</th>
<th>Land potential</th>
<th>District name</th>
<th>Land potential</th>
<th>District name</th>
<th>Land potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angoram</td>
<td>2</td>
<td>North Fly</td>
<td>2</td>
<td>Lufa</td>
<td>3</td>
<td>Tari</td>
<td>4</td>
</tr>
<tr>
<td>Finschhafen</td>
<td>2</td>
<td>Ohura-Wosera</td>
<td>2</td>
<td>Malang</td>
<td>3</td>
<td>Vansimo-Green River</td>
<td>4</td>
</tr>
<tr>
<td>Goilala</td>
<td>2</td>
<td>Pomin</td>
<td>2</td>
<td>Manus</td>
<td>3</td>
<td>Yangoru-Sasamia</td>
<td>4</td>
</tr>
<tr>
<td>Henganofi</td>
<td>2</td>
<td>Rai Coast</td>
<td>2</td>
<td>Markham</td>
<td>3</td>
<td>Angalimp-South Wahgi</td>
<td>5</td>
</tr>
<tr>
<td>Huon Gulf</td>
<td>2</td>
<td>Rigo</td>
<td>2</td>
<td>Mendi</td>
<td>3</td>
<td>Doi</td>
<td>5</td>
</tr>
<tr>
<td>Jimi</td>
<td>2</td>
<td>Sina-Sina-Yonggamul</td>
<td>2</td>
<td>Middle Fly</td>
<td>3</td>
<td>Gazelle</td>
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<tr>
<td>Kabwum</td>
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<td>South Fly</td>
<td>2</td>
<td>Namatanai</td>
<td>3</td>
<td>Govek</td>
<td>5</td>
</tr>
<tr>
<td>Kagua-Erave</td>
<td>2</td>
<td>Telefomin</td>
<td>2</td>
<td>Okapa</td>
<td>3</td>
<td>Hagen</td>
<td>5</td>
</tr>
<tr>
<td>Kainantu</td>
<td>2</td>
<td>Uluma-Bandi</td>
<td>2</td>
<td>Samaru-Marsua</td>
<td>3</td>
<td>Kerowagi</td>
<td>5</td>
</tr>
<tr>
<td>Kaeraul-Hiri</td>
<td>2</td>
<td>Abau</td>
<td>3</td>
<td>South Bougainville</td>
<td>3</td>
<td>Kokopo</td>
<td>5</td>
</tr>
<tr>
<td>Kandep</td>
<td>2</td>
<td>Aotua</td>
<td>3</td>
<td>Talaasa</td>
<td>3</td>
<td>North Bougainville</td>
<td>5</td>
</tr>
<tr>
<td>Karima-Nirmane</td>
<td>2</td>
<td>Bega</td>
<td>3</td>
<td>Teimai-Staat</td>
<td>3</td>
<td>North Wahgi</td>
<td>5</td>
</tr>
<tr>
<td>Kerema</td>
<td>2</td>
<td>Bololo</td>
<td>3</td>
<td>Unggas-Bena</td>
<td>3</td>
<td>Nukua</td>
<td>5</td>
</tr>
<tr>
<td>Kikori</td>
<td>2</td>
<td>Chuare</td>
<td>3</td>
<td>Wahag</td>
<td>3</td>
<td>Rabaul</td>
<td>5</td>
</tr>
<tr>
<td>Kompiah-Ambum</td>
<td>2</td>
<td>Dauko</td>
<td>3</td>
<td>Wewak</td>
<td>3</td>
<td>Soke</td>
<td>5</td>
</tr>
<tr>
<td>Kow&amp;a-Moke-Kapuago</td>
<td>2</td>
<td>Gume</td>
<td>3</td>
<td>Aitape-Lumi</td>
<td>4</td>
<td>Sumkar</td>
<td>5</td>
</tr>
<tr>
<td>Kundurawa</td>
<td>2</td>
<td>Laeba-Pangia</td>
<td>3</td>
<td>Ambaun-Drekot</td>
<td>4</td>
<td>Tambul-Neblyer</td>
<td>5</td>
</tr>
<tr>
<td>Lagap-Porgera</td>
<td>2</td>
<td>Ijiritari</td>
<td>3</td>
<td>Baiyer-Mal</td>
<td>4</td>
<td>Wapenamanda</td>
<td>5</td>
</tr>
<tr>
<td>Menysimu</td>
<td>2</td>
<td>Kandrian-Gloucester</td>
<td>3</td>
<td>Central Bougainville</td>
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<td>Wusera-Gaui</td>
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</tr>
<tr>
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<td>Kavieng</td>
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<td>Etaka</td>
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</tr>
<tr>
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<td>Kavisina-Goodenough</td>
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<td>Imbengo</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nipa-Karubu</td>
<td>2</td>
<td>Keroxo-Margara</td>
<td>3</td>
<td>Maprik</td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 5: Ranking of districts, from worst to best, based on agricultural pressure working values. These values reflect the agricultural pressure class that is most representative of the district population. A value of 2 represents strong agricultural pressure; a value of 3 represents moderate agricultural pressure; a value of 4 represents marginal agricultural pressure; and a value of 5 represents no agricultural pressure. Refer to page 23 for more details.

<table>
<thead>
<tr>
<th>District name</th>
<th>Agricultural pressure</th>
<th>District name</th>
<th>Agricultural pressure</th>
<th>District name</th>
<th>Agricultural pressure</th>
<th>District name</th>
<th>Agricultural pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kandep</td>
<td>2</td>
<td>Angoram</td>
<td>5</td>
<td>Karimui-Nomane</td>
<td>5</td>
<td>Okapa</td>
<td>5</td>
</tr>
<tr>
<td>Henganofi</td>
<td>3</td>
<td>Baiyer-Mul</td>
<td>5</td>
<td>Karinag</td>
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<td>Pomio</td>
<td>5</td>
</tr>
<tr>
<td>Kamamtu</td>
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<td>Bagia</td>
<td>5</td>
<td>Kerema</td>
<td>5</td>
<td>Rabaul</td>
<td>5</td>
</tr>
<tr>
<td>Bairu</td>
<td>3</td>
<td>Bulolo</td>
<td>5</td>
<td>Kerowagi</td>
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<td>Raikoa</td>
<td>5</td>
</tr>
<tr>
<td>Kompiam-Ambum</td>
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<td>Central Bougainville</td>
<td>5</td>
<td>Kikori</td>
<td>5</td>
<td>Samarai-Murua</td>
<td>5</td>
</tr>
<tr>
<td>Kundiana</td>
<td>3</td>
<td>Chuave</td>
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<td>Kokepo</td>
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<td>Sebe</td>
<td>5</td>
</tr>
<tr>
<td>Laait-Porgera</td>
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<td>Daulo</td>
<td>5</td>
<td>Koroba-Lake Kopeago</td>
<td>5</td>
<td>South Fly</td>
<td>5</td>
</tr>
<tr>
<td>Mendu</td>
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<td>Dei</td>
<td>5</td>
<td>Lufa</td>
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<td>Sumkar</td>
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</tr>
<tr>
<td>Nipa-Karubu</td>
<td>3</td>
<td>Esala</td>
<td>5</td>
<td>Madang</td>
<td>5</td>
<td>Tambul-Nebilyer</td>
<td>5</td>
</tr>
<tr>
<td>Sivi-Siva-Yonggangsogl</td>
<td>3</td>
<td>Finschhafen</td>
<td>5</td>
<td>Manus</td>
<td>5</td>
<td>Tari</td>
<td>5</td>
</tr>
<tr>
<td>South Bougainville</td>
<td>3</td>
<td>Gazelle</td>
<td>5</td>
<td>Maprik</td>
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<td>Telefomin</td>
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<tr>
<td>Gumbine</td>
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<td>Goilala</td>
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<td>Markham</td>
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<td>Tewa-Staani</td>
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<td>Hagen</td>
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<td>Middle Fly</td>
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<td>Waim-Bundi</td>
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</tr>
<tr>
<td>Rio</td>
<td>4</td>
<td>Huon Gulf</td>
<td>5</td>
<td>Middle Ramu</td>
<td>5</td>
<td>Vanimo-Green River</td>
<td>5</td>
</tr>
<tr>
<td>Talasea</td>
<td>4</td>
<td>Ialabu-Pangia</td>
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<td>Namatanai</td>
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<td>Wapenamanda</td>
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</tr>
<tr>
<td>Wag</td>
<td>4</td>
<td>Ijivari</td>
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<td>Nawae</td>
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<td>Wewak</td>
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</tr>
<tr>
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<td>Imbangga</td>
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<td>North Bougainville</td>
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<td>Wosea-Gau</td>
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<td>Yangoru-Sauma</td>
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</tr>
<tr>
<td>Alotua</td>
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<td>Kabwum</td>
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<td>North Wahgi</td>
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</tr>
<tr>
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<td>Kagus-Harare</td>
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<td>Nuku</td>
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<tr>
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<td>Kandrian-Gloascater</td>
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<td>Ouvara-Wonamara</td>
<td>5</td>
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<td></td>
</tr>
</tbody>
</table>
Table 6: Ranking of districts, from worst to best, based on access to services working values. These values reflect the access to services class that is most representative of the district population. A value of 1 represents very poor access to services; a value of 2 represents poor access to services; a value of 3 represents moderate access to services; a value of 4 represents good access to services; and a value of 5 represents very good access to services. Refer to page 21 for more details.

<table>
<thead>
<tr>
<th>District name</th>
<th>Access to services</th>
<th>District name</th>
<th>Access to services</th>
<th>District name</th>
<th>Access to services</th>
<th>District name</th>
<th>Access to services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telefomin</td>
<td>1</td>
<td>Kerema</td>
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<td>Abau</td>
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<td>North Bougainville</td>
<td>4</td>
</tr>
<tr>
<td>Alotau</td>
<td>2</td>
<td>Kokori</td>
<td>3</td>
<td>Angaimp-South Wahgi</td>
<td>4</td>
<td>North Wahgi</td>
<td>4</td>
</tr>
<tr>
<td>Jimi</td>
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<td>Kiriwina-Goodenough</td>
<td>3</td>
<td>Bayei-Mal</td>
<td>4</td>
<td>Rigo</td>
<td>4</td>
</tr>
<tr>
<td>Kandrian-Gloucester</td>
<td>2</td>
<td>Komo-Margarima</td>
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<td>Bulolo</td>
<td>4</td>
<td>Sisa-Sisa-Yenggiamugl</td>
<td>4</td>
</tr>
<tr>
<td>Koroba-Lake Kopiago</td>
<td>2</td>
<td>Kompam-Ambum</td>
<td>3</td>
<td>Central Bougainville</td>
<td>4</td>
<td>Sohe</td>
<td>4</td>
</tr>
<tr>
<td>Middle Ramu</td>
<td>2</td>
<td>Manus</td>
<td>3</td>
<td>Chuave</td>
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<td>Talaita</td>
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<td>Pomio</td>
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<td>Menyama</td>
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<td>Gumine</td>
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<td>Tumbil-Nebilyer</td>
<td>4</td>
</tr>
<tr>
<td>Usino-Bandi</td>
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<td>Middle Fly</td>
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<td>Henganofi</td>
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<td>Uogai-Bena</td>
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</tr>
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<td>Vanimo-Green River</td>
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<td>Namatanai</td>
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<td>Imbouggia</td>
<td>4</td>
<td>Wahgi</td>
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<td>Airape-Lumi</td>
<td>3</td>
<td>Naeze</td>
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<td>Kages-Erave</td>
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<td>Wepenamanda</td>
<td>4</td>
</tr>
<tr>
<td>Ambae-Drekore</td>
<td>3</td>
<td>North Fly</td>
<td>3</td>
<td>Kainantu</td>
<td>4</td>
<td>Weiaera-Giasi</td>
<td>4</td>
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## District Comparisons

Table 7: Ranking of districts, from worst to best, based on income from agriculture working values. These values reflect the income from agriculture class that is most representative of the district population. A value of 1 represents very low income from agriculture; a value of 2 represents low income from agriculture; a value of 3 represents moderate income from agriculture; a value of 4 represents high income from agriculture; and a value of 5 represents very high income from agriculture. Refer to page 21 for more details.

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Table 8: Ranking of districts, from worst to best, based on child malnutrition working values. These values reflect the child malnutrition class that is most representative of the district population. A value of 1 represents very serious child malnutrition; a value of 2 represents serious child malnutrition; a value of 3 represents poor child malnutrition; a value of 4 represents fair child malnutrition; and a value of 5 represents relatively low child malnutrition. Refer to page 22 for more details.

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Recommendations

While the handbook has not attempted to provide solutions to the predicament of disadvantaged people in PNG, the following are some key recommendations that may improve their standard of living.

1. By formally incorporating disadvantaged districts into a national policy, governments could begin to address the inequalities identified in this handbook.

2. National and provincial government policy could be implemented to support service providers, such as health workers and teachers, who work in disadvantaged districts. Incentives such as salary loadings, housing, education assistance and better communications could be provided to encourage workers to commit to their positions.

3. Access needs to be improved for people in remote areas. Planning and securing funds for on-going maintenance of roads would provide sustained benefits and a good source of local employment. Other possible initiatives include subsidies to third-level airlines to service communities living in remote areas, support for local shipping in island and coastal areas, and support for local communities to maintain airstrips and wharves.

4. Many children in remote areas suffer from malnutrition. By providing sources of income and education, particularly to mothers, the consumption of foods which are high in energy and protein could be increased. This would improve child nutrition.

5. With effective research, planning and implementation, suitable alternative cash crops could be identified. Consideration of agronomic techniques, crop protection, transport, marketing and value-to-weight ratios would ensure that identified crops are appropriate for respective areas. Private enterprise, with support from government, could carry out the promotion and marketing of identified crops to ensure that the enterprise is economically viable.

6. The flow of information to people in remote areas is critical for informed decision making. By developing reliable mechanisms to inform people in remote areas about issues such as primary health care, cash crop production, marketing and improved land management, people will have better opportunities to improve their standard of living.
Table 10: A comparison of the 20 most disadvantaged districts (index values of 11-14) identified by this handbook (2001) with those identified by de Albuquerque and D’Sa (1986) and Wilson (1974). Note that the changes in district names and boundaries since 1975 have been accounted for. The strong correlation suggests that the living standards of people in the most disadvantaged districts have not improved over the last 25 years, relative to people in other districts.

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An intensive banana garden in Gulf Province. Banana is the most important food crop in some lowland areas of Gulf, Central, Western, Morobe and East New Britain provinces. There are many varieties of banana grown in PNG, including triploid types which produce for up to 20 years if managed properly.

Steep slope gardens with soil retention barriers and planted casuarina fallows in Simbu Province. Intensive agriculture on land constrained by steep slopes has resulted in land degradation in many parts of the highlands. In some cases, slope gradients are as high as 50 degrees and villagers make soil retention barriers to help reduce soil erosion. The casuarina trees are planted to restore soil fertility and to provide timber for fuel and construction.
References


Appendices

Coconut palms damaged and killed by the 1994 Rabaul Volcano eruption. There are a number of active volcanos adjacent to population centres in PNG and these present a constant risk to human life and infrastructure. The 1994 eruptions in Rabaul destroyed most of the town, while a previous eruption of Mt Lamington in Oro Province in 1951 killed thousands of people.

Logs are loaded from a barge to a ship off the coast of Gulf Province for transport to overseas ports. Logging operations are common in the forests of Gulf Province. The royalties are a useful short-term income source for local people, but villagers receive a very small proportion of the export value of the logs. There is little evidence that income from logging royalties is being invested by people for long-term benefits.
### Appendix 1: Comparison of estimated 2000 district populations used in this handbook with preliminary 2000 census populations. Estimated 2000 populations are based on the 1980 census population extrapolated using the 1980 to 1990 inter-census growth rate. Preliminary 2000 census populations were released as this handbook went to press. Note that the estimated 2000 populations are for rural areas only, while the preliminary 2000 census populations include non-rural areas.

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Appendix 2a: Matrix used to generate child malnutrition classes for each district. The horizontal axis displays height-for-age (stunting) and the vertical axis displays weight-for-height (wasting), measured in standard deviations from the PNG national mean. The five classes of very serious, serious, poor, fair and relatively low are defined by the dotted lines. The working values used to generate the disadvantage index for each district correspond to the same five classes.
Appendix 2b: Child malnutrition statistics for each district. The N column shows the number of children under the age of five sampled in each district. The height-for-age and the weight-for-height values are expressed in standard deviations from the PNG national mean. The stunted and wasted columns are expressed as percentages of the district population.

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**Appendix 3a:** Estimated rural populations in the year 2000 in population density classes by district.

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### Appendix 3a (continued)

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The column headings show the density classes, as referred to in the text. **Low** applies to populations where the average density is 1-20 persons/km²; **Moderate** indicates densities of 21-60 persons/km²; **High** indicates 61-100 persons/km²; and **Very high** is used for densities of 101-600 persons/km². The figures in the table show the number of people in each class, rounded to the nearest hundred. Population density alone did not contribute to the ranking of the districts, as the effects of population pressure were accounted for through Agricultural Pressure and Potential (See Appendix 3g, and Table 9 in the District Comparisons section).
### Appendix 3b: Estimated rural populations in the year 2000 in access classes by district.

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The numbers in brackets in the headings are the working value classes for access to services. The highlighted population for each district is the cell which is occupied by the middle person in each district's population, once the population has been rounded to the nearest hundred and sorted into the five classes. The class that the highlighted cell is in was used to determine the working value for the whole district (Table 9, District Comparisons section). The figures in the table show the number of people in each class. For people in the Very poor class it takes over one day to reach a minor service centre; people in the Poor class require 4-8 hours' travel to reach a minor service centre; those in the Moderate class require 4-8 hours to reach a large service centre; those in the Good class require 1-4 hours to reach a large service centre; and those in the Very good class require less than one hour to reach a major regional centre. See the Data Sources, Methods and Limitations section for more information.
## Appendix 3c: Estimated rural populations in the year 2000 in income classes by district.

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The numbers in brackets in the headings are the working value classes for income. The highlighted cell for each district is the cell which is occupied by the middle person in each district’s population, once the population has been rounded to the nearest hundred and sorted into the five classes. The class that the highlighted cell is in was used to determine the working value for the whole district (Table 9, District Comparisons section). The figures in the table show the number of people who are in the five classes. People in the Very low class earn 0-20 kina/person/year; those in the Low class earn 21-40 kina/person/year; those in the Moderate class earn 41-100 kina/person/year; those in the High class earn 101-200 kina/person/year; and those in the Very high class earn more than 200 kina/person/year. See the Data Sources, Methods and Limitations section for more information.
Appendix 3d: Percentage of estimated rural populations in the year 2000 in staple crop classes by district.

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Appendix 3d (continued).
This table shows the percentage of people in each district whose gardens are dominated by any of 24 classes of dominant staple crops. An explanation of the 24 codes appears below. This information was combined with agricultural intensity (Appendix 3e) in the provincial subsistence agriculture maps. See the Data Sources, Methods and Limitations section for more information.
### Appendix 3e

Estimated rural populations in the year 2000 in agricultural intensity classes by district.

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Agricultural intensity expresses the relationship between the cropping period and the fallow period, or R value (see the Data Sources, Methods and Limitations section). The **Low** class includes R values from 1-27; **Moderate** includes values from 28-50; and **High** ranges from 51-100. The figures in the table show the number of people in each class, rounded to the nearest hundred. Intensity of land use contributed to the ranking of the districts through Land Potential (see Appendix 3f, and Table 9 in the District Comparisons section).
### Appendix 3f: Estimated rural populations in the year 2000 in land potential classes by district.

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### Appendix 3g: Estimated rural populations in the year 2000 in agricultural pressure and potential classes by district.

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### Appendix 3g: (continued)

<p>| Province name         | District name        | Very strong pressure (1) | Strong pressure (2) | Moderate pressure (3) | Marginal pressure (4) | High potential (5) | Occupied land |
|-----------------------|----------------------|--------------------------|---------------------|-----------------------|-----------------------|-------------------|---------------|---------------|
| Eastern Highlands     | Obura-Wonenara       | 200                      | 13500               | 6900                  | 0                     | 24400             |               |
| Eastern Highlands     | Okapa                | 1200                     | 200                 | 0                     | 53200                 |                   |               |
| Eastern Highlands     | Ungga-Bena           | 4200                     | 8100                | 12100                 | 7000                  |                   |               |
| Enga                  | Kandep               | 43400                    | 12700               | 10300                 | 0                     |                   |               |
| Enga                  | Kompiam-Ambum        | 22100                    | 20600               | 8400                  | 2500                  | 23800             |               |
| Enga                  | Lagaip-Porgera       | 42300                    | 23500               | 0                     | 33500                 |                   |               |
| Enga                  | Wabag                | 22200                    | 14100               | 3600                  | 27900                 | 10000             |               |
| Enga                  | Wapenamanda          | 3900                     | 4800                | 1500                  | 54100                 | 8100              |               |
| Gulf                  | Kerema               | 700                      |                     |                       | 5600                  | 33100             |               |
| Gulf                  | Kikori               |                          |                     |                       | 0                     | 25400             |               |
| Madang                | Bogia                | 100                      | 2800                | 16200                 | 0                     | 27000             |               |
| Madang                | Madang               | 1600                     | 9200                | 4100                  | 0                     | 19200             |               |
| Madang                | Middle Ramu          |                          |                     |                       | 0                     | 41200             |               |
| Madang                | Rai Coast            | 500                      | 1800                | 2300                  | 0                     | 39300             |               |
| Madang                | Sumkar               | 7200                     |                     |                       | 29800                 | 10500             |               |
| Madang                | Usino-Bundi          |                          | 1100                |                       | 0                     | 37300             |               |
| Manus                 | Manus                | 1000                     | 200                 |                       | 2400                  | 30800             |               |
| Milne Bay             | Alokau               | 3000                     | 3100                | 5000                  | 9100                  | 40400             |               |
| Milne Bay             | Esala                |                          |                     |                       | 2500                  | 11800             | 30400         |
| Milne Bay             | Kiriwina-Goodenough  | 300                      | 3900                | 22700                 | 7900                  | 13100             |               |
| Milne Bay             | Samarai-Murua        | 1100                     | 1700                | 9600                  | 5700                  | 22700             |               |
| Morobe                | Bulolo               | 200                      | 2400                |                       | 4200                  | 32900             |               |</p>
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The numbers in brackets in the headings are the working value classes for agricultural pressure and potential. The highlighted cell for each district is the cell which is occupied by the middle person in each district's population, once the population has been rounded to the nearest hundred and sorted into the six classes. The class that the highlighted cell is in was used to determine the working value for the whole district (Table 9, District Comparisons section). The figures in the table show the number of people in each class. Occupied land refers to land which does not fit into any of the classes used. The Very high agricultural potential class does not contain any people, as it refers to areas which have very high potential and no agriculture, and are therefore not currently used for cultivation. The same explanation applies to the No agricultural pressure class. These classes are not shown in the table. See the Data Sources, Methods and Limitations section for more information.
Appendix 3h: Estimated rural populations in the year 2000 in disadvantaged people classes by district.

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Province name and District name are not fully visible due to image resolution.
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This table shows the number of people in each district who are constrained due to 13 combinations of conditions, or who are not disadvantaged relative to other people in PNG (code 14). An explanation of the disadvantage codes appears below. See the Data Sources, Methods and Limitations section for more information.

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Appendix 3h (continued)

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<th>Code</th>
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<td>Moderate pressure, very low income, poor access</td>
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<tr>
<td>3</td>
<td>Poor environment, very low income, poor access</td>
</tr>
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<td>Strong pressure, very low income</td>
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<td>9</td>
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<td>14</td>
<td>Not disadvantaged relative to other areas</td>
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</table>
There are significant and growing disparities among rural people in Papua New Guinea. Some people earn relatively high incomes and have access to a range of health, education and information services. Other people are poor, remote and marginalised, often because of where they live. Given that there is very little information available about rural areas in PNG, national and provincial governments, non-government organisations and international development donors struggle to answer questions such as:

- Where do the most disadvantaged people live and what are the constraints they face?
- Where are rural people migrating to and why?
- How much money do rural people earn and what are the main sources of income?
- Where are the priority areas for the development of roads and other infrastructure?
- Where are the most suitable areas for future agricultural development?
- Where are environments degrading?

This handbook provides some answers through the presentation of factual information, analysis, maps, tables, graphs and photographs for each province and rural district in the country. It brings together information that has been collected for over 50 years and is designed to answer the questions of students, teachers, researchers, planners and development practitioners.

Luke Hanson, Dr Bryant Allen, Dr Mike Bourke and Tess McCarthy are from the Research School of Pacific and Asian Studies at the Australian National University in Canberra. Their work is funded by the Australian Agency for International Development (AusAID).