Agriculture in Papua New Guinea: Conditions, Future Prospects and Dispelling some Myths

By Dr Mike Bourke
Demographic Background

- The estimated mid-2008 population for Papua New Guinea was 6.5 million
- This consisted of:
  - 81% rural villagers (5.3 million people)
  - 13% urban (0.8 million people)
  - 6% rural non-village (0.4 million people)
- Population growth rate is 2.7% pa (1980-2000)
Rural Villagers

- Based on cash income and other measures, rural villagers may be further sub-divided into:
  - Not poor - 39% (2.1 million in mid-2008)
  - Marginally poor 42% (2.2 million in mid-2008)
  - Extremely poor 18% (1.0 million in mid-2008)
- It is people in the first group and some in the second group which produces most of the cash crops and have the highest consumption rate for imported goods.

Land use in PNG

- In 1975, only 26% of PNG's mass was used for agriculture (fallows, food gardens, tree crops)
- This figure has grown to about 30% now
- The remaining 70% has never been used for agriculture
- This is because it is too swampy, too steep, rainfall and cloud cover are excessive, or it is too high (above 2800 m altitude)
- Even within the 30% that can be used for agriculture, there are often severe limitations.
- Only 7% of the total land area is classed as high or very high quality and a further 20% is of moderate quality for growing crops
- For example, the most common soil type in Western Province is a Ultisol, which are infertile and have limited potential for agricultural production
- There is a close association between population density and productivity, with the highest population density in the best agricultural environments.
Association between land quality and population density

Population density (per/sq km)
Food Production and Consumption

- 83% of food energy consumed in PNG is locally produced (cf 80% in 1996)
- 76% of food protein in PNG is locally produced
- Imported rice and wheat-based foods provide less than 15% of food energy
- Subsistence food production is keeping pace with population growth
- Consumption of imported food (rice, wheat-based, meat, fish, fresh food) per person has been static or has declined over the past 15 years (since 1994)

**Figure 2.1.1** Proportion of energy and protein derived from locally produced and imported foods, 2006.
Source: Table A2.1.1 and author's calculations.
Figure 2.1.2 Source of energy and protein by main food groups, 2006. Source: Table A2.1.1 and author’s calculations.
Locally grown foods

- Sweet potato is the most important locally grown food
- Production of sweet potato and cassava has increased greatly over the past 40 years
- Production of taro, sago, yam and banana has been fairly static over the past 40 years, but has declined as a proportion of total food production and consumption

![Pie charts showing food production by crop]

Figure 2.2.2 Estimated production of food energy of staple food crops: Survey of Indigenous Agriculture, 1961–1962 and Mapping Agricultural Systems of PNG Project, 2000. Note: Rice was estimated as 0.4% of food energy of the staple food crops in 1961–62, and as 0.03% in 2000. Sources: Walters (1963); Bourke and Vlassak (2004).
Food staples from 1660-2000

1660
- Yam (12%)
- Colocasia taro (50%)
- Banana (22%)
- Sago (16%)

1880
- Sweet potato (40%)
- Colocasia taro (18%)
- Sago (16%)
- Yam (9%)
- Banana (17%)

1940
- Chinese taro (1%)
- Colocasia taro (16%)
- Sweet potato (41%)
- Sago (16%)
- Yam (9%)
- Banana (17%)

1960
- Chinese taro (4%)
- Cassava (2%)
- Colocasia taro (9%)
- Sweet potato (45%)
- Sago (16%)
- Banana (16%)
- Yam (8%)

1980
- Cassava (4%)
- Colocasia taro (6%)
- Sago (11%)
- Sweet potato (55%)
- Banana (12%)
- Yam (6%)

2000
- Cassava (6%)
- Colocasia taro (4%)
- Sago (7%)
- Sweet potato (66%)
- Banana (8%)
- Yam (5%)
Domestically marketed food

- Domestically marketed food has expanded greatly over the past 35 years, and particularly since 1998
- This is associated with the devaluation of the PNG currency vs. US dollar
- This resulted in steep increases in the price of imported food
- Increased demand for locally grown food since 1998 coincided with poor returns to highland coffee producers
- Many highlanders responded by increasing production of sweet potato and other fresh foods for sale in local and lowland markets
Exchange rate for one PNG kina against the Australian dollar and United States dollar, 1975-2007
Average retail price of rice in Port Moresby and Madang, 1971-2007
Average per person rice imports into PNG and trends by decade, 1961-2007

Average per person wheat imports into PNG and growth trends by decade, 1961-2007
Volume of meat imports into PNG from Australia and New Zealand, 1983-2004

Annual consumption of sugar in PNG per person, 1983-2007
Cash cropping

- The main sources of cash income for rural villagers are various agricultural enterprises.
- These are (in order of total income for villagers):
  Arabica coffee, fresh food, cocoa, betel nut/pepper, copra, oil palm, firewood, fish/seafood, tobacco, cattle, vanilla, Robusta coffee, animal plumes and crocodiles.
- Oil palm is now the most important agricultural export, but only 4% of rural villagers are involved in oil palm production.
- Note that products in both the formal and informal sectors are important.
Figure 5.2.2 Contribution by value of the main cash crops to agricultural exports, 2002–2006 (annual mean)

- Palm oil: 31%
- Coffee: 25%
- Cocoa: 16%
- Other*: 19%
- Copra and Copra oil: 6%
- Rubber: 1%
- Tea: 2%

* 'Other' includes canned tuna, canned beef, processed tea and coffee, spices, and minor commodities such as artefacts, crocodile skins and butterflies. Vanilla was a major component (about one-third) of the 'other' category for the period 2002–2006.
Figure 5.2.3  Contribution by value of the main cash crops to agricultural exports by decade, 1951–2006
Sources: Bank of PNG and various industry sources.
Betel nut trade routes in PNG, 2007
Production trends for most important trade crops

- Arabica coffee – Static total production; declining plantation sector; slow growth of village sector.
- Fresh food - Steady to fast expansion, especially since 1998.
- Cocoa – Steady expansion, but declining plantation sector; return of village production in Bougainville.
- Betel nut and pepper - Rapid expansion and domestic trade (urban, RNV and highland demand).
- Copra - Steep decline in copra exports, but copra oil steady.
- Oil palm – Very rapid expansion of production (10% pa), with smallholders producing 33% of fresh fruit.

Smallholder agriculture

- Smallholder agricultural producers are dynamic
- Producers respond to both price signals and to marketing opportunities
- Over past 10 to 20 years, there has been expanded production of domestically marketed fresh food, betel nut, marijuana, oil palm, vanilla, cocoa, oil palm, peri--urban chickens and goats.
Influences on smallholder production and decision making

- Returns to labour are critical
- Marketing arrangements (e.g. chilli in early 1980’s; copra in 2002; fresh food to Porgera in 2005).
- Adequacy of transport (roads and shipping).
- Information of marketing, prices, demand and production techniques
- Security for people and produce

Gross returns on labour inputs for selected cash crops in PNG in 2007

<table>
<thead>
<tr>
<th>Crop</th>
<th>Mean yield (kg/ha)</th>
<th>Price (kina/kg)</th>
<th>Gross return (kina/ha)</th>
<th>Labour input (person-days/ha)</th>
<th>Return (kina per person-day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irish potato (tubers)</td>
<td>20 000</td>
<td>2.00</td>
<td>40 000</td>
<td>450</td>
<td>89</td>
</tr>
<tr>
<td>Oil palm (fresh fruit bunch)</td>
<td>15 000</td>
<td>.25</td>
<td>3 750</td>
<td>70</td>
<td>54</td>
</tr>
<tr>
<td>Sweet potato (tubers)</td>
<td>14 000</td>
<td>.80</td>
<td>11 200</td>
<td>450</td>
<td>25</td>
</tr>
<tr>
<td>Cocoa (wet bean)</td>
<td>800</td>
<td>1.00</td>
<td>800</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Arabica coffee (parchment)</td>
<td>900</td>
<td>4.50</td>
<td>4 050</td>
<td>275</td>
<td>18</td>
</tr>
<tr>
<td>Rubber (cup lump)</td>
<td>650</td>
<td>1.60</td>
<td>1 040</td>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td>Coconut (copra)</td>
<td>500</td>
<td>1.30</td>
<td>650</td>
<td>65</td>
<td>10</td>
</tr>
<tr>
<td>Robusta coffee (parchment)</td>
<td>900</td>
<td>1.60</td>
<td>1 440</td>
<td>275</td>
<td>5</td>
</tr>
<tr>
<td>Rice (paddy)</td>
<td>1 300</td>
<td>.80</td>
<td>1 040</td>
<td>215</td>
<td>5</td>
</tr>
<tr>
<td>Pyrethrum (dried flowers)</td>
<td>650</td>
<td>1.50</td>
<td>975</td>
<td>430</td>
<td>2</td>
</tr>
</tbody>
</table>
Global Climate Change

- The global climate is changing because of increases in greenhouse gases (carbon dioxide, methane, nitrous oxide)
- Impacts in PNG include:
  - Temperature increases (Mean of 0.6°C, 1970-1999, lowlands; greater in highlands)
  - Sea level rises (now accelerating globally)
  - Changing rainfall patterns; predicted increased rainfall for much of PNG – seems to be happening
  - Possible higher frequency of extreme events (cyclone, drought, excessively high rainfall)
Temperature change, Kavieng 1973-1999

Daily maximum temperature
- Deviation from average daily maximum temperature
- 5 year running mean

Mean daily temperature
- Deviation from average daily temperature
- 5 year running mean

Daily minimum temperature
- Deviation from average daily minimum temp.
- 5 year running mean

Year

Temperature Anomaly (°C)

1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8

Sea level change (cm)

Three-year tide gauge average

Satellite altimetry

Year
Current impact of climate change on PNG agriculture

- Crops now growing higher in the highlands (e.g. coconuts, betel nut, mango, breadfruit)
- Some damage to coastal locations, including atolls and very small islands
- Claims of ‘sinking islands’, food problems on some islands (e.g. Duke of York Isles; Carteret Is)
- Changing production patterns, perhaps associated with changes in rainfall (e.g. reduced cocoa production in SW Bougainville)

Potential impacts on PNG agriculture

- Crops will have higher altitudinal limits
- Greater incident of damage from extreme events (flood, excessive rainfall, drought, cyclone, high tides)
- Possible decrease in productivity in lowlands (e.g. cocoa, sweet potato)
- Small decrease in productivity in central highlands (1600-2000m)
- Small increase in productivity at higher altitudes (2000-2500m)
- Severe damage to many coastal locations, particularly atolls and small islands (e.g. swamp taro production)
- There are 1000 people in PNG who live on small islands where population density is high
- Probably greater plant disease incidents with higher temperatures and rainfall (e.g. taro blight, coffee rust).

Future prospects for PNG agriculture

- PNG smallholders have shown themselves adaptable and responsive to changing circumstances
- Good prospects for a number of products sold domestically and on the export market
- High returns on labour inputs are critical for success
- Also marketing arrangements

New products: current research and development

- Cassava, sago, Jatropha, castor, corn and copra for bio fuel
- Cashew nut (Central Prov. and Markham Valley)
- Kava
- Essential oils, such as cardamom, patchouli, nutmeg, citronella
- Bamboo for edible shoots and timber
- Non-timber forest products, such as marita oil (pandanus)
New product: current research and development (continued)

- Sago starch
- Sandlewood
- Peanuts
- Galip nut
- Noni
- Prawn farming
- Cut flowers for domestic market
- Essential oils, such as cardamom, patchouli, nutmeg, citronella

Best prospects: domestic markets

- Domestically marketed food, including roots crops, banana, sago, fruit (mandarin, mango, rambutan, mangosteen, durian), indigenous edible nuts, vegetables
- Snack foods, such as peanuts, cassava chips, banana chips, cooked galip, cooked karuka nut
- Betel nut and betel pepper
- Fish (fresh, dried)
- Livestock (pigs, chicken, goats)
- Flowers, particularly for funerals

Best prospects: export markets

- Oil palm: current rapid expansion
- Hardwoods, including teak, kwila, New Guinea walnut (mon), Calophyllum, rosewood, kamarere and ton
- Fast growing timbers such as balsa, Acacia mangium and Eucalytus pellita
- Flowers, particularly indigenous orchards
- Cocoa: Reasonable prospects, but depends on CPB (cocoa pod borer)
- Vanilla
- Other spices, particularly essential oils from spices
- Indigenous edible nuts (galip, karuka, okari, pau, talis)
Figure 5.13.1 Volume and value of balsa exports, 1996–2007

Poor to average prospects: export markets

- Coffee: global supply is high, especially from Vietnam and Brazil. Quality problems in PNG
- Tea: global supply is high. Small size of PNG industry; one company only now
- Rubber: moderate prospects; depends on price of crude oil. PNG industry is static
- Copra: low prices, has to be exported as copra oil, with very limited market of copra now

Very poor prospects

- Grains for domestic market, including rice, wheat, maize sorghum (low returns on labour; huge past effort with little development)
- Pulses, such as soyabean, green gram
- Robusta coffee (low prices)
- Pyrethrum (very low returns)
- Fresh food exports
- Canned food for domestic markets
Role of agriculture in the PNG economy

- Agriculture provides 80% of food energy consumed
- Major source of cash income for most rural villagers
- Provides informal employment for many people (e.g. middlemen, transport, retailing of betel nut)
- Significant contributor to local development
- Useful contribution to export income (but just 17% of export income)
- Agriculture’s greatest contribution is to food security, local and regional development, national stability but not to export income
**Figure 5.2.1** Value of major exports, 2004–2006 (annual mean). Source: Bank of PNG.
Concluding remarks

- PNG agriculture has a bright future
- The mix of activities will be different in future decades, as it has been in past decades
- PNG agriculture needs to be supported by high class research and development
- It is important to build on current and past success and to learn from the past
- The new book Food and Agriculture in Papua New Guinea is a contribution to that process