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Solomon Islands Smallholder Agriculture Study

Volume 2

Subsistence Production, Livestock and Social Analysis



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T Jansen, BF Mullen, AA Pollard, RK Maemouri, C Watoto and E Iramu

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For further information about the
Australian overseas aid program, contact:

AusAID Public Affairs Group

AusAID

GPO Box 887

Canberra ACT 2601

Phone 02 6206 4727

Facsimile 02 6206 4695

Internet www.ausaid.gov.au

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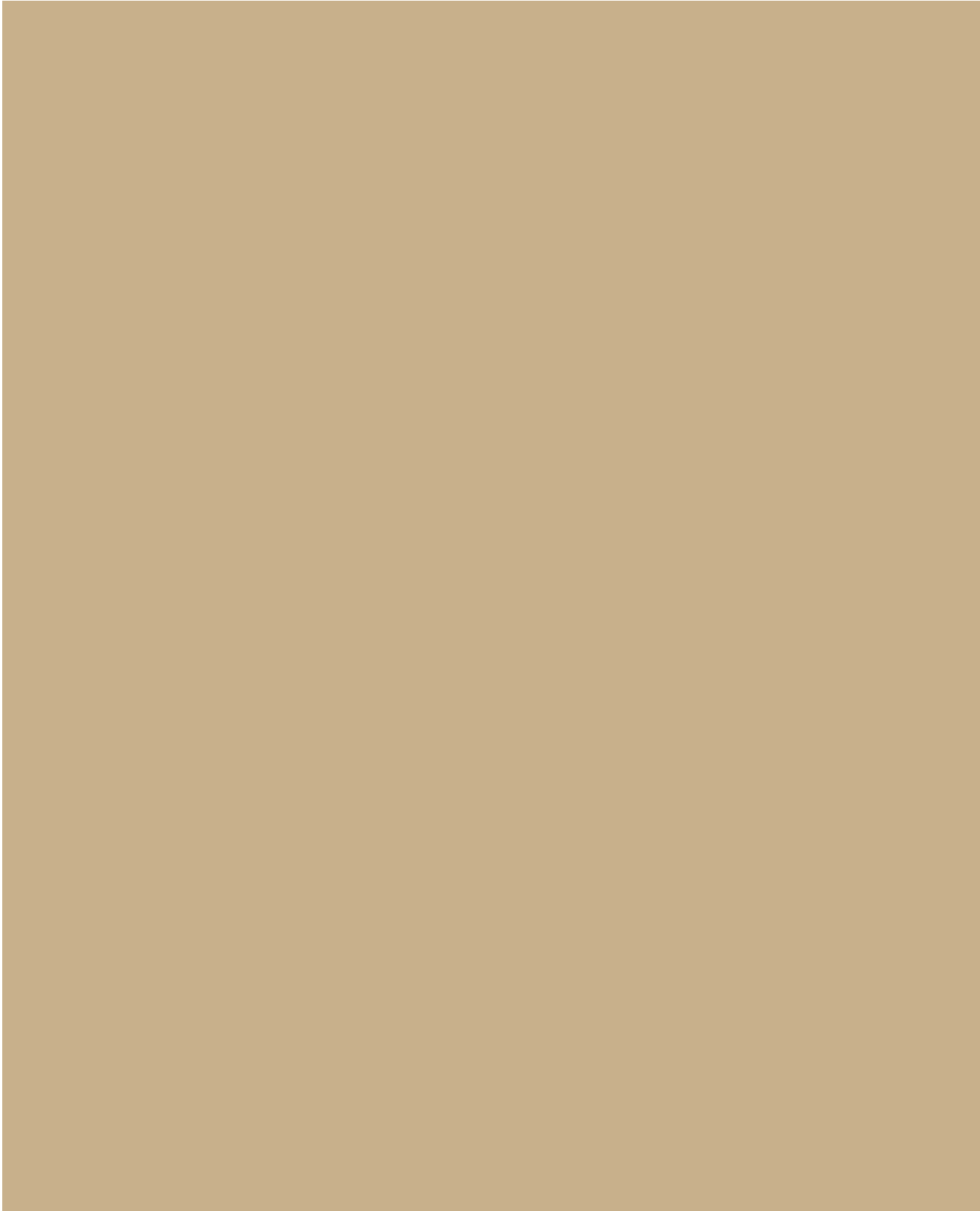
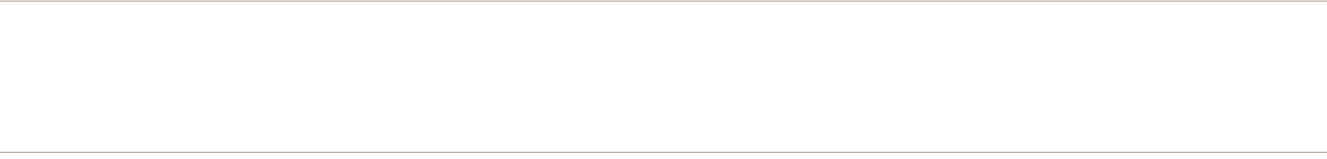
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Acronyms

ACIAR	Australian Centre for International Agricultural Research
CEMA	Commodities Export Marketing Authority
CPRF	Community Peace and Restoration Fund
DAL	Department of Agriculture and Livestock
EU	European Union
GDP	gross domestic product
kg	kilogram
KGA	Kastom Gaden Association
LDA	Livestock Development Authority
NGO	nongovernment organisation
NZODA	New Zealand Official Development Assistance (now New Zealand Agency for International Development — NZAID)
OIE	World Organisation for Animal Health (formerly the Office International des Epizooties)
PMN	Planting Material Network
PNG	Papua New Guinea
RIPEL	Russell Island Plantation Estates Ltd
RTC	rural training centre
SDA	Seventh Day Adventist
SI	Solomon Islands
SPC	Secretariat of the Pacific Community
SITARTC	Solomon Islands Association of Rural Training Centres

Currency convention

The currency used throughout, unless otherwise stated, is the Solomon Island Dollar (SI\$), with an exchange rate of SI\$1.00 = A\$0.20 in September 2004.



Figure 1 Map of Solomon Islands, showing the main island groups

Preface

THE SOLOMON ISLANDS SMALLHOLDER AGRICULTURE STUDY IS A SERIES OF FIVE VOLUMES WHICH DOCUMENT THE DEVELOPMENT OF RECOMMENDATIONS FOR A SET OF AGRICULTURAL INTERVENTIONS SUPPORTING BOTH SUBSISTENCE AGRICULTURE AND INCOME-GENERATING ACTIVITIES FOR RURAL COMMUNITIES IN SOLOMON ISLANDS.

It presents recommendations for the implementation of the study findings, as well as some of the background research that provides the rationale for their development.

The series is based on studies in SI from September to November 2004. The 13-person study team (see Appendix 1.2 for member biographies) consisted of: Matthew Allen, Mike Bourke (co-leader), Barry Evans, Ellen Iramu, Roselyn Kabu Maemouri, Andrew McGregor, Ben Mullen, Alice Aruheeta Pollard, Morgan Wairiu, Claudine Watoto and Stav Zotalis (co-leader). AusAID staff members, Geoff Fox and Nadira Mailewa, also contributed, and Sarah Goulding guided the process. Assistance was received from many people in Solomon Islands. In particular, field staff of the AusAID-funded Community Peace and Restoration Fund (CPRF) facilitated the fieldwork in the provinces.

The studies were conducted in two phases:

- > Phase 1 involved a five-week study, which was undertaken from August to September 2004 in Brisbane, Canberra and Honiara by Barry Evans, with technical assistance from Mike Bourke and others. The report of this study has been included in this series as Volume 5, *Literature Review: A Brief National Assessment of the Agriculture Sector*.
- > Phase 2 involved a comprehensive in-country study of the agricultural sector. The study was conducted over a period of five weeks in SI from September to October 2004. The team undertook visits to seven of the nine provinces in SI, and

information on the remaining two provinces was based on interviews and information gathered during previous visits by some team members. This study was complemented by the work undertaken by Andrew McGregor (a marketing specialist) on marketing issues, which was completed in November 2004 (see Volume 3).

The smallholder agriculture study complements the work undertaken under the broader Australian program of assistance to SI, which focuses on interventions in the law and justice sector, machinery of government, economic governance, health and education sectors, and the community development sector, as well as small-scale interventions focused on promoting peace building.

Volume 1, *Main Findings and Recommendations*, draws on the findings of the two-phased study to present a series of recommendations for enhancing rural livelihoods in SI, including recommendations for interventions to implement the study. Appendix 1.1 provides a cost–benefit analysis by Andrew McGregor of the proposed recommendations, which includes a detailed analysis of returns to both labour and land, as well as information on international market prices for current and potential export crops.

Volumes 2–5 contain considerable support material for the recommendations that are developed in Volume 1.

Volume 2, *Subsistence Production, Livestock and Social Analysis*, covers livestock issues (Ben Mullen), an overview of subsistence agriculture (Tony Jansen),

and gender, social and cultural issues (Alice Aruheeta Pollard).

Volume 3, *Markets and Marketing Issues*, was written by Andrew McGregor and describes the detailed marketing analyses on which Volume 1 is based. In particular, Volume 3 provides justification for the recommended interventions that are detailed in Chapter 10 of Volume 1.

Volume 4, *Provincial Reports*, comprises individual reports on the constraints and opportunities for agricultural interventions in the nine provinces. They cover: Central (Matthew Allen, principal author), Choiseul (Matthew Allen and Ben Mullen), Guadalcanal (Mike Bourke), Isabel (Morgan Wairiu), Makira (Morgan Wairiu and Ben Mullen), Malaita (Mike Bourke), Rennell and Bellona (Barry Evans), Temotu (Morgan Wairiu) and Western (Barry Evans) provinces. Each provincial report was based on four to seven days of fieldwork per province, except for Choiseul and Temotu, which were based on interviews and other sources.

Volume 5, *Literature Review: A Brief National Assessment of the Agriculture Sector*, was written by Barry Evans and gives a broad overview and assessment of information on the agriculture sector in SI.

Volume 1 of this study was sent to a number of SI and Australian Government departments, several international development organisations and two academic referees for comments and review. The Solomon Island departments consulted were: Agriculture and Livestock, the Central Bank, and National Reform and Planning. The Australian Government departments were Finance, Foreign Affairs and Trade, and Treasury. Other agencies that commented on the draft document were the Asian Development Bank, European Union, New Zealand Aid and the World Bank. One academic referee was based in Australia, the other in the United Kingdom. The comments that were received have been incorporated in the final version where possible.

1 Subsistence food production

SUMMARY

In Solomon Islands (SI), subsistence food production involves the use, management and creation of different physical environments to produce and/or harvest different products and carry out different functions in the farming systems.

Subsistence food production has been the traditional way of life in SI, and is still critical for the livelihood and food security of rural populations.

However, subsistence food production can sometimes fail, because of factors such as extreme weather, interruptions to planting cycles, and disease and pest outbreaks, or because of pressures associated with an increasing population. These factors can result in short or long-term stress, forcing rural families to resort to emergency foods. Identifying regions experiencing, or susceptible to, stress is critical for developing effective and appropriate agricultural and economic management strategies to help rural communities overcome conditions that adversely affect their livelihoods.

This chapter examines agriculture systems and identifies areas of SI suffering environmental and economic stress, to help direct the development of recommendations to improve rural livelihoods. Section 1.2 (*Overview of subsistence food production*) provides an overview of subsistence food production in SI, including how food is grown, the major types of food crops grown, and the impact of subsistence on communities.

Section 1.3 (*Stress caused when subsistence fails*) uses field-work observations, personal conversations and information from agriculture projects to identify the key indicators and causes of short and long-term stress. Key indicators of stress include:

- > regular consumption of stress foods
- > short fallows in gardens
- > declining diversity of crops
- > absence of taro in farming systems
- > ngali nuts being cut for timber or firewood
- > importation of building materials from other areas
- > high levels of urban migration.

Causes of both short and long-term stress include:

- > population growth
- > development and environmental degradation
- > erosion of traditional society and knowledge
- > restricted access to money-earning opportunities.

Section 1.4 (*Case studies: provincial differences*) uses these key indicators of stress to identify specific regions of SI that are experiencing moderate, high or extreme stress, including areas with high population densities, small islands and atolls, extreme environments (eg Guadalcanal Weather Coast), groups with insecure land tenure, and extremely isolated regions. In order to be successful, recommendations for improving the livelihood of rural communities in SI must take into account environmental factors, social coping mechanisms,

resource management, and the need for sustainable sources of cash.

1.1. INTRODUCTION

Subsistence food production involves cultivating, harvesting and managing foods from different environments, the most important being shifting cultivation gardens, but also including fallow forests, primary forest, swamps and mangroves. Soil fertility in gardens is maintained through a bush fallow in most farming systems.

Subsistence agriculture is the main livelihood for most of rural households in SI. These rural households make up 85% of the population. Complete subsistence (100% self-reliance at a family level) is rare and possibly may not occur at all. Semisubsistence is the norm and is probably a more accurate definition; however, for the purposes of this chapter, *subsistence food production* refers to producing food for local consumption. This includes consumption by the producers themselves (almost all are family based), as well as sharing, exchanging and selling food in the local area.

Sharing food within complex social relationships and obligations has a high value within SI society. Subsistence food production meets this need. Subsistence products are important for nutrition, and provide the basis for mixed and nutritious meals. Processed foods are increasingly consumed in rural areas, and this change in diet is threatening health. Increased income often equates with increased consumption of foods of poor nutritional value.

Subsistence food production makes an important contribution to the rural cash and noncash (or subsistence) economies, and is done almost exclusively in family or household units. The amount of labour available within a household is a key limitation for food production and for developing other livelihoods. Subsistence food production provides security for individuals to move in and out of cash-earning activities as such opportunities become attractive enough or available. Local markets are found throughout the country, and the sale of food products in local markets is a critical source of regular income for

most households. Local markets are particularly important because women are more likely to control this income source and can use it for meeting basic family needs.

As the population of SI grows, agricultural methods are changing. Fallow periods have been reduced and the cropping period before fallow has been extended. This intensification, in combination with the adoption of new crops such as sweet potato, has been very successful to date. It has also influenced the economy by increasing the number of markets, increasing the diversity of food types being sold in these markets, and increasing opportunities for rural communities to earn cash — thereby encouraging the transition to a cash economy.

Agricultural intensification of this type has its limits, however, and these limits are being reached or exceeded in areas of highest stress where fallow periods are no longer long enough to restore soil fertility adequately. This is resulting in steady land degradation, combined with decreased productivity and increased pressure on land use, and is undermining food security. People in rural communities do not earn enough through paid employment or selling crops in the cash economy to survive on a cash-only basis. A subsistence economy is needed as well, with opportunities for earning cash available as ‘insulation’ in times of agricultural and economic stress.

1.2 OVERVIEW OF SUBSISTENCE FOOD PRODUCTION

The following sections provide background information on how food is produced in the SI subsistence system and the major food crops that are grown and sold. The contribution of the subsistence system to the rural economy, and how the economy is affected by social and cultural issues, is discussed. Changes, caused largely by an expanding population, are also identified.

1.2.1 PRODUCING FOOD

Garden types

In a subsistence food production system, food comes from gardens cultivated under shifting cultivation, as well as forest (primary forest), fallows (secondary forest), mangroves, reef, deep sea, rivers, plantations, nut groves, swamps, and agroforests (planted tree crops of mixed usage, including food and timber) around the village and in the bush. These environments form part of subsistence food production in a complex mosaic of resource-use and resource-management decisions. These diverse farming systems are adaptable and resilient to stress.

'Garden' or food production land ranges from cultivated gardens to mature, closed-canopy rainforest. A forest fallow is used to restore soil fertility, along with other traditional methods of building soil fertility during cropping. All the stages of ecological succession during fallow, from viny bush to pioneer secondary forest and mature, closed-canopy rainforest, are used for different purposes — mostly related to collecting various wild products. For example, in the Babatana language of the Choiseul Province, there are 14 words for bush, each referring to distinct stages of ecological succession and different types of forest. Each 'siniqa', or forest type, has its own particular products and uses. Consequently, the fallow periods in farming systems (ie the stages or level of ecological succession) have a direct effect on the availability of various forest products, including foods, building materials, medicines and wild animals. It is difficult to separate food production from the forest, because the two are intimately related, as seen in the many references to the impact of logging and other changes to forest resources on food production.

Shifting cultivation gardens or fields are cultivated for one to four plantings before land is left to fallow. This is typically a sequential pattern with one end of a garden area steadily extending into recently cleared bush fallow, and the other end left to progressive stages of young bush fallow. This system works well for regular production of root crop staples and is well-suited to limited family-

based labour. Often, a number of families will work in one area on their individual garden plots for some years and then abandon the whole area for a longer fallow and move on to another part of their tribal land. The allocation and decisions over family use of tribal land for food production, particularly gardens, are complex and variable, and are beyond the scope of this chapter. Generally, once a site has been cultivated, it remains in that family's hands for future use after fallow.

Often, the land around villages is seen by outsiders as a radial expansion of cleared areas into untouched forest, which is a false impression. Instead, much of the forest has probably been under cultivation in the past. What is changing, and this is a critical factor in identifying areas of stress, is the intensity of cultivation with a shortened fallow period and an extended cropping period. Intensification has obvious implications for soil fertility and productivity, but also has implications for the availability of a large range of other products that come out of forest fallows. This range of products traditionally contributed to food security and rural livelihoods, especially in times of stress.

Fallow periods under shifting cultivation are traditionally 15–25 years. All but the most sparsely populated places in SI are shortening fallows to 5–9 years, with the most extreme land pressure reducing fallows to four years or less. Under a 5–9 year fallow, the farming systems still appear to be fairly, or even very, productive. The concern is that with continuing (and rapid) population growth in the near future, many areas will have to further reduce fallow periods, which will bring them into the high land pressure category.

Slash and mulch systems on Guadalcanal in particular appear to reduce the fallow period to around 4–5 years while sustaining high yields. There are few other examples of traditional methods being used to enhance soil fertility, although some are mentioned later in this chapter. Extending the cropping period is also a form of intensification. A mixture of short and longer fallows also occurs, and in the highest pressure areas (such as parts of north Malaita), this tends to involve a cycle of short fallows under 12–18 months, followed by a longer fallow of 2–5 years when the soil is completely exhausted.

It is difficult to objectively measure fallows from farmers in terms of number of months or years. Traditional concepts and labelling of fallow vegetation have more to do with the size and species of vegetation rather than the number of years. This difficulty is compounded in environments where the growth of fallow vegetation and succession slows with increasing environmental degradation.

Maintaining soil fertility

There are few examples of traditional methods of maintaining soil fertility. Notable exceptions are Guadalcanal's yam and sweet potato slash and mulch farming systems, where crops are planted under partly cleared fallow vegetation and the remaining vegetation is cut onto or around the growing crops. In other farming systems, particular crops are grown without burning, or by adding organic matter. For example, fallow debris is often heaped in rows along plot boundaries and this compost heap is a fertile place for certain plants. In Malaita, 'edu' (*Alocasia taro*) is planted under ringbarked bush and the leaves are allowed to fall onto the crop to form a mulch layer. From interviews with old women in different parts of the country, it seems that the uniform burning of gardens, which is commonly practised today, was not the practice in the past. Fire was used as a tool to kill large trees, and organic matter was heaped and burned at certain points. Today, as fallows shorten, it is common for bush to be cut on the spot, left to dry, and then set on fire across the whole garden. As intensification occurs, so does fire intensity. Where intensification is most extreme on the Suava Bay peninsula, some farmers carry coconut leaves to their bush gardens to cover the soil and set them on fire, because the bush fallow had little of its own vegetation. Farmers were associating poor growth with the lack of fire, and their experience suggested they were getting higher yields when mulching instead of burning in that same farming system.

Rather than maintaining or building soil fertility, traditional knowledge centres on understanding soil. Experienced farmers are experts at detecting different soil types and even soil microclimates within a cleared garden for different crops. The expansion of cropping periods is likened to crop

rotation, but it is more like a soil-mining process, where one root crop after another is planted to carefully exhaust the last nutrients from the soil (eg a sequence of taro, sweet potato and cassava).

On the atolls, permanent cultivation is practised on mulched swamp and *Colocasia* taro plots. Organic matter is collected and buried in the soil in preparation for planting.

There are many examples of recent innovations to improve soil fertility. Examples include composting for 'sup sup' (kitchen) gardens close to the house; using chicken manure and other composts in gardens (particularly for cash crops, such as melon or Chinese cabbage); improving fallows with a cover crop under rotation (*Pueraria*); experimenting with crop rotation using legumes; and using legume trees in various adaptations of alley cropping systems.

Cash crops and land pressure

Historically, coconut plantations exacerbated land pressure in many areas, particularly north Malaita. Expansion of coconut, cocoa, teak and other cash crop plantations continues to be a problem, mainly because of poor land-use planning and management decisions. Often, these decisions are made by men without involving women, who are more aware of food production needs. The result is that plantations often occupy the best land close to villages while food gardens are forced onto more distant and steep land, increasing women's workload. In some areas of Toambaita in Malaita, this means women have to walk up to two-and-a-half hours to reach distant gardens and find productive land.

As land pressure increases, planting cash crops has become an assertion of land ownership and can increase land pressure as people rush to occupy and claim their land with permanent crops. New cash crops tend to follow a boom–bust model, with misinformation and unrealistic expectations leading to a wild boom that is inevitably followed by disappointment when crops are less productive than expected. This pattern has already been seen in chilli crops. Vanilla and teak are currently going through a similar phase.

The diversion of family labour to expanding cash crops can undermine subsistence food production and increase vulnerability if cash crops fail. This has happened with melon farmers in the Takwa area of north Malaita. These farmers invested heavily in time and cash resources in melon cropping and, in some cases, relied on income to support their food and other needs. This has proven to be a high-risk strategy, given that a number of melon crops failed because of pest and transport problems.

While the general pattern of food production in SI is of intensification, there is evidence that agriculture is expanding into new areas that were not previously under cultivation. This expansion of cultivated land is mainly caused by land and population pressures, and is also associated with migration to new settlements. For example, Mana'abu village in north Malaita was settled only three to four generations ago. Before that, the village was a 'tabu' (forbidden) primary forest that had never been cultivated. Today, there is virtually no primary forest left and all the land is under short fallows and extreme pressure. Conversely, there are other areas that were under cultivation in the past but have reverted to permanent forest cover. For example, the interior of Choiseul and Kolombangara were once inhabited (there is evidence of this in the form of ngali nut groves and tabu sites), but today some areas are uninhabited and only used for hunting.

While the diverse system of food production in SI centred on shifting cultivation and has sustained rural populations for millennia, it is by no means a static system. Over the past 50 years, there has been remarkable change and innovation, including the adoption of new crops and cultivars. For example, sweet potato has spread to become the main national staple (and there are many other examples of new crops being integrated into farming systems). Other changes include new cultivation techniques — particularly mounding, intensifying land use through shortened fallows, and extended cropping cycles. On the economic side, rural markets have flourished and there has been a huge diversification in the range of products and the tastes of rural and urban consumers. For example, an old woman in Sasamuqa reported that in the 1960s and 1970s, the range of products in the

local market was limited and did not include cooked food. Today there is a wide range of vegetables and different products, including many cooked foods, and new opportunities to earn small amounts of cash, compared with the past where copra was almost the only option.

1.2.2 MAJOR FOOD CROPS GROWN

This section describes the main food crops grown and consumed in SI (additional information on these crops is also available in Appendix 2.1). These crops form the basis of both the subsistence and cash economies, but are slowly being supplemented, or replaced, by imported, processed foods.

Starchy staples are still the main, daily food source for the rural population. In all provinces, sweet potato is now the most important staple, replacing taro. Cassava is of increasing importance, especially in areas of stress. Other root crops, cooking bananas and breadfruit have an important role in certain locations, seasonally or as secondary staple crops. Cultivar diversity is high for taro, banana, yam, sweet potato and some others. Cultivar and species diversity in gardens is a successful traditional and current strategy to reduce risk and meet multiple needs.

Food sources

Leafy greens are consumed in large quantities and complement staples and fish to provide a balanced meal. Consumption of slippery kabis, the most important leafy green, is declining in many areas because of pest problems. Many other leafy greens from gardens, as well as locally important wild harvested leaves (such as fern, *Ficus* and *Gnetum*) are also consumed. Beans and vegetables are increasingly important for income through sale in local markets and to add variety to diets in response to changing tastes. Nuts, especially ngali, are important seasonally with high cultural, and in some cases economic, value. A wide range of different indigenous and exotic fruits are grown in villages and in the bush and have varying importance and uses from place to place.

Starchy staples form the basic daily food of the rural population. These are mostly root crops with the

important addition of bananas. Breadfruit is also an important seasonal food in some provinces. Root crop diversity is very high, both in terms of mixtures of species within farming systems and at the cultivar level within each species. Women are primarily the collectors and maintainers of crop diversity and are continually collecting, screening and exchanging germ plasm to build up a range of cultivars suitable to their particular garden environments (ie soils and local microclimates), as well as to their tastes and needs. For traditional crops, particularly taro and yam, individuals, families, clans and tribes may have rare, locally specific cultivars that have been maintained for generations.

While locally produced starchy staples are important, they are increasingly being supplemented or replaced by rice and other processed carbohydrates (including white flour, noodle, navy and other biscuits). Imported rice has become a staple food together with the root crops, and is purchased from a network of trade stores throughout the country after importation from Australia, China, and Thailand. Rice is considered a high-status food and also is attractive for convenience and transportability — hence urban wage earners send regular bags of rice and other store goods to rural relatives.

Consumption of processed foods has become a national obsession, and noodles and small quantities of tinned fish or meat are added to almost all meals. The reasons for this change and its

negative and positive consequences are complex and beyond the scope of this chapter; however, locally produced alternatives could add value to the rural economy and improve nutrition.

The following sections briefly describe important crop species from a national perspective. For each, a scoring table uses four criteria to assess their importance for daily consumption, for sale in markets, in times of stress, and in seasonality of production. The scores are subjective and are based on the author’s personal observations and experiences. Scores are between 1 and 5, with 5 being very important and 1 being not important.

Starchy staples

Root crops require regular planting and harvesting, because storage times are short — ranging from a few days for tubers damaged during harvesting and transport, to a maximum of two weeks. Yams are an exception, because they can be stored for several months. Cassava has the advantage of storing well in the ground, and various cultivars extend the harvesting period for sweet potato. Table 1.1 shows an importance matrix for starchy staples in SI.

Leafy greens

Leafy greens are critical for good health because of their high content of vitamins A, C and other nutrients. Rural households are large and must produce large quantities of greens in addition to starchy staples as the daily food. Where possible and

Table 1.1 Starchy staples importance matrix

CROP	DAILY CONSUMPTION	MARKET SALES	EMERGENCY / STRESS FOOD	SEASONAL
Sweet potato	5	5	1	No
Cassava	4	3	3	No
Taro	2	4	1	Minor
Yam and pana	3	4	2	Strong
Banana	3	5	3	No
<i>Xanthosoma taro</i>	3	3	1	No
<i>Alocasia</i>	1	4	1	No
<i>Kakake</i> (swamp taro)	1	1	5	No
Breadfruit	1	1	3	Strong
Rice (cultivated)	1	1	0	No
Sago	1	1	2	No

Scale: 1 = not important; 5 = very important

Table 1.2 Major leafy greens importance matrix

CROP	DAILY CONSUMPTION	MARKET	EMERGENCY / STRESS FOOD	SEASONAL
Slippery kabis	5	5	3	Minor
Fern	5	5	5	No
Pumpkin tips	4	3	4	No
Taro leaf	3	3	3	No
Amaranth	2	1	2	No
<i>Ficus</i>	3	2	5	Partly
<i>Gnetum gnemon</i>	3	2	4	Partly — in flushes
Bonio	3	1	4	No

Scale: 1 = not important; 5 = very important

Table 1.3 Major fruits importance matrix

CROP	DAILY CONSUMPTION	MARKET	EMERGENCY / STRESS FOOD	SEASONAL
Pineapple	3	5	1	Yes
Pawpaw	3	3	3	No
Watermelon	2	5	0	Yes
Guava	4	2	0	No
Five corner	2	3	0	No
Pomelo	3	3	0	No
Inkori (golden apple)	3	3	0	Yes
Bush apple	3	3	0	Yes
Wild mango	3	4	0	Yes
Rambutan	1	4	0	Yes

Scale: 1 = not important; 5 = very important

when available, leafy greens are mixed with meat or fish, but a plate of greens cooked in coconut milk on top of boiled or 'motu' staples is the most common daily food across SI (see Table 1.2).

Fruits

Fruit trees are grown in a number of different zones, including:

- > around house and village
- > as understory trees in coconut plantations
- > mixed in nut groves
- > semiwild or managed in the bush
- > at old settlement sites in the bush
- > cultivated as crops in gardens.

Fruits are important for nutrition for the same reasons that leafy greens are important. Fruits

are common around villages and usually freely harvested by children. The nutritional value of fruits is often poorly understood with most fruits not seen as 'real' food with the same value as cooked food. Sale of fruits is important as an income earner when sold in local markets and at schools. Table 1.3 shows a major fruits importance matrix.

1.2.3 IMPACT OF SUBSISTENCE ON COMMUNITIES

This section describes how subsistence affects rural communities in SI. Impact on the economy, including the interaction between subsistence and cash economies, the use of the cash economy, and the existing constraints on both types of economies, are examined. The roles of gender and social structure in food production and management are also discussed.

Impact on the economy

Despite the little available data, the noncash value of subsistence food production is undoubtedly large. World Bank reports have estimated it at 40% of the gross domestic product (GDP), although it may be higher. For example, sweet potato is the country's major agricultural product but it does not register in economic reports or in many planning decisions; most likely because it is not exported and trade is either in the local cash or subsistence economy, where little data, and little tax, are collected.

Interaction between subsistence and cash economies

Importantly, subsistence food production provides security for rural producers to increase or decrease their involvement in the cash economy as opportunities arise or decline. This is a significant pattern across the country, with families seizing temporary economic opportunities for a short period of time and then disengaging for a period of time, before reengaging with the same or other economic opportunities. The reasons for disengagement are complex but often concern an immediate need for cash (a common example is paying annual school fees), or because the risk of returning to labour is too high. This flexibility acts as a food and social security net in times of stress, including civil unrest or other economic and social stresses. Rural families are able to easily reallocate their labour to increase or decrease subsistence production or dependence in most locations, when needed. There are important exceptions; the main one being that as stress increases, the ability to disengage from the cash economy reduces without causing significant hardship.

Many cash economy activities, including the smallholder plantation sector and parts of the urban unskilled labour market, appear to be at least partially subsidised by the subsistence economy. This means that people are not earning enough in paid employment or through selling their products in the cash economy to sustain themselves purely on a cash basis. In practice, this means that participating in the cash economy is often only temporary, or — if continuous — is subsidised by the subsistence production occurring within the same family. In urban areas, there has been little

if any analysis of the flow of noncash food from rural areas to urban wantoks (meaning literally 'one talk' or people of one language, but also referring to a wide grouping of relatives to whom a person is obligated socially). Low-income earners in urban areas, particularly Honiara, often depend on cassava gardens on the urban fringe for their food security.

Use of the cash economy: domestic and local markets

Rural produce markets are located throughout the rural areas. They usually operate one to three times per week. Often, the market site moves to different locations on different days of the week. These markets tend to be bigger and have more turnover in areas close to government or other paid workers in the rural areas (eg schools, clinics, health centres and mission stations). In areas of higher population, however, it is often surprising how much money and produce changes hands (eg the markets in Lau lagoon, where Solwara and bush people trade). These markets are busy and attract hundreds of people once or twice a week.

Small markets also occur at centres of activity, such as secondary and primary schools, church administrative centres, government substations, church hospitals, health centres and rural training centres (RTCs). Urban markets are in the provincial centres and vary from the large markets of Gizo and Auki to small, occasional markets in places like the Taro township. Despite the small size of these townships, demand for markets is high; however, transport costs and distance often make selling difficult.

Vegetables are important for marketing and seem to be traded as much as they are consumed at the family level. Vegetable sales in local markets, along with the sale of root crops and leafy greens, are probably the most important source (although not necessarily the largest source) of income for a majority of rural families. Women tend to control local produce marketing and have more control over cash earned. When produce is sold in more distant locations (eg the provincial capital or Honiara), men are more likely to be involved.

Apart from betel nut trade where there is a sophisticated chain of growers, traders and middlemen, there are few examples of middlemen

buying up produce for sale in other markets. This is surprising given the often very large price disparity between rural and urban markets. An exception is the development of a trade between Honiara and Auki, where people travel on the Ramos ship to buy produce in the Auki market, returning the next or same day to Honiara to sell it at a mark-up price. In general, growers and buyers are suspicious of middlemen and work hard to discredit them with typical Melanesian 'jealousy'.

Existing constraints on the subsistence and cash economies

A key constraint to subsistence and small-scale commercial agriculture on customary land is the availability of labour and the return to labour. Despite common perceptions of having a desperation to earn more cash, rural people often expect a reasonably high return to their labour in order to engage with any consistency in the cash economy. People will quite quickly move back to subsistence if the cash return on their labour is poor. An example is the collapse in copra prices in the early stages of the ethnic tension. Plantations were abandoned — not because of the lack of a market (this happened later with the closure of the Commodities Export Marketing Authority (CEMA) buying points), but because the price offered was too low. Although many families had few other options apart from semisubsistence (ie producing for themselves and local markets), most families chose the latter. It is difficult to put a value on the minimum return for labour expected, because it varies from place to place. Often, withdrawal from certain enterprises has more to do with an intuitive feeling of poor returns — hence the common pidgin term 'hemi had woka tumas' ('it is too much hard work'). This is a common comment after a few crops or experimentation of growing rice.

The concept of *subsistence affluence* is worth considering. In areas of low stress, there is a subsistence comfort zone for many people that does not drive them into the cash economy. This can be seen as a positive aspect of the rural economy and demonstrates the importance of subsistence to the local economy by rural people. However, there are many hardships, because a higher level

of real subsistence is reached and most families aim for a balance of good return to labour cash-earning activities and subsistence. Economic growth (such as commercial logging) that undermines the subsistence base often leaves people in real poverty as opposed to cash poverty. The ideal would be to provide more cash to provide flexibility and options combined with strengthened subsistence.

Impact of social structure

Sharing and providing good food within and between families is important culturally, and its integral place in Melanesian culture should not be undervalued. It would be unacceptable for most families to turn away visitors or relatives, and the capacity to provide extra food for sharing during these occasions, as well as sending food to relatives and giving away food to visitors, has a higher social value than any new concepts of business, economic growth or saving. Rural people 'invest' their wealth in social relationships and social security nets.

The current, noncommunicable disease health issues facing the country are almost all related to increased consumption of imported processed foods in a poorly balanced diet. In rural areas, the diet of white rice with small amounts of tinned fish (Taiyo) and noodles has almost become a second staple in many areas, along with navy biscuits and sugary tea. These foods are replacing the traditional healthy and balanced meals, causing a huge cost to the country in terms of rising diabetes, heart disease and infant malnutrition (which is as high as 20–30% in most provinces although data are poor). In the experience of the author, these lifestyle diseases, particularly diabetes, are equally common in rural and urban areas.

In areas where there is a traditional custom money economy (eg Malaita, Guadalcanal and Makira), subsistence food production products, such as pigs, taro, *Alocasia* taro, yams and ngali nuts, are converted into shell money wealth. Shell money is variously used for bride prices, paying compensation for breaking social norms, and for land and other custom settlement issues. It can also be directly converted to cash. Accumulation of shell money, particularly in Malaita, is a goal of many families and is essential for participating in Malaitan society.

Shell money also represents a form of noncash savings that can be converted to other uses at a later date.

Impact of gender roles

Gender roles in subsistence food production vary from area to area, but generally follow a common pattern. Typically, men carry out garden clearing and some of the hoeing and soil preparation. Women then plant, weed, harvest and carry produce back to the village. In long-fallow sites, this pattern is still typical. For short fallows, especially less than five years, women take an increasing burden of the work because they are seen as capable of clearing short-fallow vegetation. In this way, the workload of women increases as stress increases and productivity declines.

Cash crops, such as copra or cocoa, are typically organised by men. Women and other family members are used as labour while men sell, produce and manage cash. In contrast, local marketing of garden produce is more often done by women than men. Cash cropping and farming tends to be men's business and this has been reinforced by male-dominated agriculture extension services. Many women are too intimidated or afraid to seek extension services from an office staffed by male workers.

Although women grow the majority of cash crops, some crops are managed by men (eg taro in Malaita); however, this pattern is not consistent (in Choiseul, taro is almost exclusively a women's crop). In general, the gender division of roles tends to be more pronounced in coastal areas where men are more likely to be engaged in fishing, and women engaged in agriculture. But there are variations: in Temotu, women fish as much as men, while in Choiseul, women's fishing is rare. Instead, women collect bush foods and shells from the reef, and make decisions about crop cultivars and planting materials. In bush communities, men and women are more equally involved in all stages of the food production cycle.

In some provinces, women and children's timelines in Participatory Rural Appraisal exercises indicate the heavy workload and social commitments that

women, in particular, face. They might spend two or three days a week in their gardens and then fulfil heavy commitments to community, school, church and women's group activities on the remaining days of the week. These timelines show that a key constraint of production and income-generating activities is the availability of labour within family units. People are keen to earn income but may not have the necessary free time to do so. Any income-earning activity needs to be carefully assessed to ensure it does not detract from food production or other important social obligations within the community.

Intensification has increased the workload on women and, increasingly, young men are less involved in food production than in the past. Women are largely responsible for collecting and maintaining crop cultivars, make most decisions on what is planted in food gardens, and are responsible for most wild harvesting of plant foods.

1.3 STRESS CAUSED WHEN SUBSISTENCE FAILS

In the context of this chapter, stress relates to food shortages that are caused when subsistence food production fails. Stress can have a subsequent effect on social, cultural and economic aspects of the SI rural communities.

Stress can be short or long-term. Short-term stress can occur in any region of SI; however, it is generally associated with regions already under long-term stress.

In the following sections, the key indicators of stress (both short and long-term) are listed. Causes of both types of stress are then summarised, and examples of specific regions affected by long-term stress are given. Finally, subsistence responses to stress are identified. Section 1.4 uses this information to identify specific regions of SI that are suffering from medium to high stress, and therefore require assistance to improve rural livelihoods. These are presented as case studies.

1.3.1 KEY INDICATORS OF STRESS

The successful development of recommendations to help improve or maintain the livelihoods of rural communities in times of subsistence stress relies on accurately identifying areas experiencing stress. Table 1.4 lists the key indicators that can be used to identify both short and long-term subsistence stresses.

1.3.2 TYPES OF STRESS

Population growth is the driving force behind the development of both short and long-term stress. Growth, and therefore pressure, on land and resources is worsened by large-scale resource destruction (eg logging and mining), which rapidly

reduces available land and leaves communities suffering from environmental and social side effects.

Vulnerability is not only influenced by the physical constraints, but is also strongly influenced by the social coping mechanisms — that is, how intact the traditional means of coping are. Consequently, people on apparently vulnerable atolls are not at such a high risk as they might appear, because their traditional society is functioning well. Conversely, inappropriate use of food aid and changing beliefs and expectations has undermined traditional stress survival strategies in many parts of SI. Examples include the decline in planting of family *kakake* plots, destruction of traditional wild yam resources, and general erosion of traditional knowledge

Table 1.4 Key indicators of stress

CONSUMPTION
Regular consumption of <i>kakake</i>
Regular consumption of mangrove fruits
Consumption of wild yams
Loss or disappearance of bush foods from common use (eg fern, tulip, <i>Ficus</i> , mushroom)
Very limited range of foods in diet
GARDENS
Short (less than 5 years) fallows and or extended cropping periods
Less and declining diversity in gardens
Taro absent from farming system
Poor/slow recovery of fallow vegetation after gardening and dominance of tough ferns that recover quickly after fire
Grasslands/weedy bush becoming dominant vegetation
Increasing land disputes over garden sites (eg 'closure' of gardens under custom practices)
Fixed garden boundaries even under fallow
Stones 'coming up' in garden land — ie soil erosion
Cassava becoming the dominant crop
Planting gardens under coconuts
Clearing coconuts to make space for food gardens
Increasing pest and disease problems (often due to gardens in increasing proximity to each other; declining plant health due to lower soil fertility; and poor pest — predator balance due to declining habitat in garden and fallow diversity)
OTHERS
No availability of lawyer cane (<i>Calamus aff. holhrungii</i>) as rope for building houses, or other basic bush house building materials, such as palms for flooring (have to import from other areas)
Ngali nuts cut for timber or building material
Disputes over timber trees; importation of timber from other areas for house construction
High levels of urban migration

related to stress survival and sustainable resource management.

A second key influence on stress survival is the access to money-earning options. Areas of short or long-term stress that have options to engage in the cash economy can use money to insulate them against the periods of stress. This was apparent in the El Nino drought when many food gardens failed and families diverted their efforts to increasing copra production to make money for buying rice and other store foods.

The interplay between environmental factors, traditional social coping mechanisms, resource management and sustainable or appropriate sources of cash income are key issues in understanding stress locations and developing strategies to assist them.

Short-term stress

Short-term stress can affect any area, but is more likely to occur, recur, or have a more severe impact, in areas already under long-term stress.

Short-term stress is mostly caused by:

- > weather extremes
 - excessive or seasonal wet weather leading to sweet potato crop failures
 - landslides and flooding leading to destruction of garden areas — could be caused by excessive wet weather, cyclones or earthquakes
 - drought such as the 1997 El Nino drought that caused crop failures and forest and garden fires across SI
 - cyclones — related to excessive wet weather as well as wind damage to gardens and tree crops in the southern and eastern provinces
- > interruptions to the planting cycle leading to later food shortage
 - social commitments, such as Christmas, weddings, feasts, fundraising
 - social dislocation, such as the internal displacement during the ethnic tension
 - very bad weather interrupting work in gardens

- health problems or changes in labour availability within a family

> pest and disease outbreaks

- problems affecting slippery kabis and taro are particularly serious.

Long-term stress

Table 1.5 shows the main patterns of long-term stress, and examples of affected areas.

1.3.3 RESPONSES TO STRESS

To cope with stress, rural populations traditionally resorted to emergency foods, including *kakake*, wild yams, mangrove fruits and other bush foods.

Bush foods

There are many species of edible foods that can be harvested from garden fallows to primary forest. An ethnobotanical project in the Babatana area of Choiseul (Jansen and Sirikolo¹) documented 87 species of edible plants, including leaves, mushrooms, fruits, yams, nuts and edible palms. These foods were much more important in the past but are resorted to in times of stress, provided the traditional knowledge regarding their use is available. Bush foods, such as *Gnetum*, *Ficus* and fern, have become common and are even cultivated or at least managed in many places. These foods are used as an important backup in time of stress or crop failures.

Some major types of bush foods used in times of stress include:

Kakake — a regular or seasonal food in some areas, and in other areas, is resorted to when there is nothing else to eat.

Wild yams — wild yams are the last resort in times of disasters, such as cyclones, or the recent ethnic tension that forced people into the bush and left them unable to return safely to their gardens. In Bellona, yams are common in secondary vegetation and in some places, have been bought into cultivation (eg Temotu and Choiseul), where they are planted as a reserve food.

1 Jansen T and Sirikolo M (in press). *Lauru Land Conference of tribal Community*, Honiara.

Table 1.5 Patterns of long-term stress and affected areas in Solomon Islands

AREAS OF VERY HIGH POPULATION DENSITY	
Serious stress	Artificial islands Solwara people in Lau and Langa Langa lagoons Much of coastal north Malaita as far south as Kwara'ae and Kwaio (particularly east Kwaio)
Moderate stress	Parts of bush areas of Malaita Localised land pressure within walking distance around very large villages or groups of villages found in a few locations in most provinces (including Gilbertese settlements)
AREAS OF LOW PRODUCTIVITY OR DIFFICULT ENVIRONMENTS	
<i>Small, densely populated islands</i>	
Serious stress	Santa Ana and Santa Catalina in Makira; Simbo and other small settled islands in lagoons in Western Province Manoba, Basakana and Dai islands in north Malaita Islands in Marau Sound in Guadalcanal Province Reef Possibly Tikopea and other small islands in Temotu
<i>Next range of larger, small islands</i>	
Moderate stress	Savo in Central Province Ulawa in Makira Small Malaita Possibly some islands in Shortland group
<i>Atolls</i>	
Serious stress	Ontong Java Pelau Sikiana group Anuta (however, these are probably partially balanced by largely intact traditional coping mechanisms due to the extreme isolation)
<i>Extreme environments</i>	
Serious stress	Weather Coast of Guadalcanal Makira
Possible moderate stress	Weather coast of Ranonga, Western Province
<i>Insecure land tenure</i>	
Moderate — low stress	Gilbertese settlements in Choiseul and Western Province (also are small islands) Possibly Tikopean settlements in Makira and Guadalcanal (lack of information) Emerging landless groups as a result of historical and internal migrations within provinces (eg bush people who have resettled in coastal areas in Malaita) Urban and urban fringe settlements who are low-income earners Groups displaced or limited in land opportunities by historical and present commercial developments (eg Kolombangara, Guadalcanal Plains, Gold Ridge, Russell Islands)
<i>Extreme isolation and lack of opportunity</i>	
Serious — moderate (depending on distance from road or port)	Bush communities in Malaita, Guadalcanal, Makira and Isabel

Mangrove fruits — an important seasonal food, particularly in Malaita, but also in some other provinces (eg Choiseul and Western provinces). Their use has spread among Seventh Day Adventist (SDA) communities. In Malaita, mangrove fruits are a popular food, especially mixed with mangrove shells and vegetables. However, consumption is also an indicator of short-term stress (eg when bad weather makes garden work or garden access difficult, or when crops fail due to excessive rain or drought). In many parts of north Malaita, mangroves are being overexploited for timber and firewood due to population pressure, and this food source may be under threat in the future.

Wild mushrooms — often have an important place in households and local markets. Mushrooms that grow on rotten sago palm are particularly popular and common.

These bush foods are important minor or underused crops and their production and use should be seen as part of the shifting cultivation cycle. Therefore, these foods begin to disappear from short fallow areas (eg north Malaita) unless actively managed (eg tulip in north Choiseul) and solidus or brought into cultivation (eg Reef Islands).

There is enormous potential for further development of these underused crops by bringing them into cultivation, enhancing their management, or through developing nontimber forest products. Some work has been done in this area through variety improvement using rapid domestication techniques (Roger Leakey and Richard Pauku, Agroforestry and Novel Crops Unit, School of Tropical Biology, James Cook University, Australia, pers comm 2004).

Encouraging higher use and enhancement, and therefore increasing the value of forests, will become critical for rural livelihoods and food security for many communities. Forests represent capital for the future and the sale of timber is probably the most viable form of savings and long-term wealth accumulation available to rural communities.

1.4 CASE STUDIES: PROVINCIAL DIFFERENCES

Throughout SI, regional differences mean that most provinces have some areas of higher stress than other parts. For example, north Malaita has the largest area of population stress; however, smaller pockets of similar stress (especially on small islands and around very large settlements) can be found. Some changes occur between provinces in farming systems and cropping patterns, with variations in staples and more often local variations in the secondary staples and crops. In all provinces, rural families practise a mixture of food production and cash cropping. Cash crops, particularly tree crops, have worsened land pressure in some cases but provide important sources of flexible income for most.

The following sections identify specific regions of SI that are suffering from medium to high stress, and therefore require assistance to improve rural livelihoods. For each province, a brief description notes any substantial deviations from the norm, as well as notable areas of stress. For more information on specific geographical areas of SI, see Volume 4, Chapters 1–9.

1.4.1 TEMOTU — SERIOUS STRESS

Temotu is an isolated province and is closer to Vanuatu than to Honiara. Cultivation practices on the larger island of Santa Cruz are fairly typical, with the important exception being that Temotu is a centre of domestication and plant breeding with specialised tree crop cultivars unique to SI (including ngali nut, breadfruit, pometia, alite, and spondias). Families traditionally plant mixed groves of useful trees, with breadfruit being the dominant tree, particularly in Reef Islands (an area of high population pressure with a limiting environment). This system has been improved through the work of a few highly motivated individuals within the Department of Agriculture and Livestock (DAL), who have developed a system called Improved Temotu Traditional Agriculture. This system has enormous potential for adaptation to other areas of high land stress, and the experiences of intensification in the Reef Islands,

through increased use of tree crops, is a neglected success story.

While Temotu appears to be important for collecting produce, Temotu Province has been sensitive to the export of varieties and has passed by-laws to control this. Extensive collections are alive, but neglected, at Tenaru on Guadalcanal.

Tikopea is an outlying small island inhabited by Polynesians. It was hit by a massive cyclone in January 2003, which wiped out much of the vegetation, buried productive soil in 3 metres of sand and opened a freshwater lake to the sea, destroying taro cultivation areas and freshwater sources. Remarkably, no-one was killed and the ability to prepare for, survive, and recover from such a disaster is evidence of the intact survival and security mechanisms in such an isolated place. This and other outlying islands in Temotu are often visited by ships only every six months, so total self-reliance is a necessity.

1.4.2 MAKIRA-ULAWA — LOW TO MODERATE STRESS

Makira-Ulawa is a sparsely populated province whose people are renowned for a comfortable subsistence. An interesting variation in this province is the importance of bananas as a staple food, consumed throughout the year, and the high cultivar diversity. Approximately 150 banana cultivars are maintained at the Manivovo training centre in southeast Makira as part of a collection under the Planting Material Network (PMN). A second collection in Central Bauro highlands maintains more than 30 distinct highland varieties.

Makira has abundant forests that have become the recent focus of multinational logging companies as forests are exhausted in other provinces. Logging is one of the most significant threats to subsistence and livelihoods in Makira. Island areas of Santa Ana, Santa Catalina and, to a lesser extent, Ulawa, are under high population pressure, have less productive environments and are identified as areas of stress.

As an indication of the feeling of central government neglect, Makira Province declared independence from SI in late 2000, but the declaration was largely ignored. This isolation, and frustration at the lack of development, is at its most extreme on the weather coast of Makira, which suffers from developmental constraints similar to those of the Guadalcanal Weather Coast. In one case in recent years, this frustration and lack of information and opportunities led to the importation of toxic waste from Taiwan in an attempt to raise money by providing land dumping sites.

Tikopean settlements in Makira are a result of overcrowding on Tikopea and Anuta. These could possibly be future flashpoints for land and resource disputes, because the Tikopean population is growing rapidly. Things are stable at present, because the settlements are within an area of low population density. However, such a situation has not prevented disputes in Gilbertese settlements in Choiseul and Western Province. Makira may be an area where more rapid land-use intensification could be useful to prevent future disputes.

Makira has a reasonably large bush population in the central part of the island, with a large number of scattered and isolated hamlets. These people are extremely disadvantaged in terms of isolation and access to market opportunities, and must walk for a day or more to reach the small urban centre of Kirakira.

Morou Bay is an area of agricultural potential, where peanuts and other crops grow well on a fertile plateau (400–600 m elevation). A large commercial logging operation has begun on the plateau in recent months and is threatening the development potential of the plateau. Despite being labelled as a region with development potential, Morou Bay remains an isolated and forgotten part of the country. An agriculture training centre run by DAL on the plateau has failed to deliver any development gains. This experience is similar to that of other DAL training and research centres scattered across SI, where often the staff have been running their own farming or other business and doing little else while receiving government salaries.

1.4.3 MALAITA — HIGH STRESS

As the most populated province, Malaita suffers from more extreme and widespread land pressure than all other provinces. North and central Malaita are the most densely populated. Across Malaita are significant numbers of bush communities — most with only walking access to the coast and transport. In parts of east Malaita, people walk across the island rather than wait for irregular shipping, or making expensive outboard motor journeys.

Farming systems vary considerably between coastal (Solwara) and bush communities. In coastal areas, sweet potato and cassava are the dominant crops, with taro only a minor crop composed of resistant varieties, excluding the prized *Alomae*-susceptible taro. Yams are important seasonally in most areas but particularly in the lowlands. In Lau Lagoon, farmers have developed melons as a significant cash crop with large monoculture plots using high external inputs.

In coastal areas, 'edu' (*Alocasia* taro) is dominant in some farming systems and has an important cultural and economic value. Mangrove fruits form an important reserve food in lagoon areas although this resource is increasingly under threat from clearing for firewood, timber and new settlements. Trade between saltwater and bush people is an ancient one in Malaita. Market sites stand in traditional locations and are governed by customary rules. In the past, these markets functioned through barter and although this system still occurs today, arrangements between two parties are more often made.

Artificial islands, such as Lau and Langa Langa, all have short fallows. Most forest cover, apart from tabu sites, is gone and the few large trees standing are fruit and nut trees. In these areas, as well as Toambaita, ngali nuts are being cut down for firewood and building materials — an indicator of severe stress.

Internal displacement is an emerging issue in many parts of Malaita. Along with urban migration, there has been a steady process of internal migration from bush to coastline, or nearer to coastal areas, to have better access to services and opportunities. Following the ethnic tension, people are returning

to their lands, often displacing others who had settled there and who, in turn, are forced to return to distant bush ancestral lands where opportunities are very limited.

The trend of widespread development of satellite communities and new settlements is probably most advanced in Malaita but can also be observed in other provinces. Many people are returning to small, extended family-based hamlets where development of land and decision making are easier than in large communities, which are often involved in land and other disputes.

This trend of internal displacement and migration is creating an emerging 'land poor' — a national trend that is most advanced in Malaita. Land poor are people and households who, for various reasons, do not have primary land rights in the area in which they live. This may be a result of intermarriage, or historical or more recent migrations. In the past, such families were accommodated through complex relationships that gave them and their children security for the future. These systems appear to be increasingly breaking down.

Malaita is renowned for taro cultivation (330 cultivars collected in two limited areas of the province by the PMN) but also for its taro diseases, *alomae* and *bobone*. Highland areas have now developed a niche for marketing taro to Honiara and also to other coastal rural markets in Malaita. For some of these highland communities, taro is their sole significant income earner.

South Malaita is much less densely populated and farming systems are similar to those of other less-populated provinces. This region also depends on sea transport (north Malaita has two main trunk roads). South Malaita is reported to be a centre of yam and taro diversity.

The use of 'tafuliae' or shell money is an interesting local economy in Malaita that operates in parallel with the cash economy.

1.4.4 GUADALCANAL — LOW TO EXTREME STRESS

Guadalcanal has four distinct zones — the plains; the northwest area (which is seasonally dry during the southeast trade winds with a rain shadow effect

from the large mountains); the northeast, which is typical of other parts of SI with good soil, abundant rain, relative isolation from markets; and the weather coast with its massive rainfall and severe geography of mountains dropping straight to a wild coastline with no safe harbours.

Guadalcanal covers the extremes of situations faced by rural communities in SI, with the plains having the greatest opportunities for marketing (and the greatest negative effects of urban living). The weather coast is perhaps the most disadvantaged area of SI, with little opportunity apart from a precarious subsistence in a difficult environment. The environment is reasonably productive, with good soils, but the extremely high rainfall, steep land and lack of safe harbours on a wild coastline make it a difficult place for development. Weather coast settlements on North Guadalcanal were established following a massive earthquake in the 1970s, which buried villages in landslides and raised a new coastal island off Avuavu. Migration to North Guadalcanal and dissatisfaction on the weather coast were key factors in the uprising on Guadalcanal, in combination with settlement pressures on North Guadalcanal.

Grasslands on north and northwest Guadalcanal appear to be the result of repeated burning preventing the re-establishment of secondary forest; however, they have been present since the time of Mendana. This is an area with potential for rehabilitation under agroforestry.

Small and locally overpopulated islands in Marau Sound suffer from localised land pressure due to relatively high population and less productive environments. They are surrounded by a sparsely populated mainland but have little access to land. This was a flashpoint during the ethnic tension.

1.4.5 CENTRAL PROVINCE — MEDIUM STRESS

Most of Central Province is probably somewhere in the medium category of land pressure, but includes some large villages with localised higher land pressure. A particular issue in the Florida islands group is the grasslands, which are reported to be slowly spreading like the grassland on Guadalcanal.

Rehabilitation of these lands could open them up for agriculture or, more likely, agroforestry.

Savo has a small land area for the population and is likely to face land problems in the near future — if not already — and short fallows are already practised. Savo and Ngela people rely on marketing various products in Honiara, including betel nut, vegetables and bush building materials like sago palm. Russell Islands have been extensively logged and were the subject of a major dispute over logging in the Pavuvu area in the 1990s. Villagers burnt down logging company operations; however, logging proceeded with police protection. Adding to these pressures are the extensive commercial plantations, pressure from plantation workers and longer-term settlements, and land shortages.

1.4.6 RENNEL AND BELLONA — HIGH STRESS

Bellona is a small island under very high land pressure. Fallow periods have shortened and elders report they are very concerned about the future of cultivation on the island. Signs of stress include growing crops under coconuts. Bellona is hit regularly by cyclones, and wild yams in secondary forest are actively maintained for such emergencies. These managed wild food sources are being threatened by agricultural intensification. A large proportion of the Bellona population is in Honiara so migration is currently an outlet for the local land pressure. The lack of interest in agriculture by young people and the transfer of a semiurban culture to the island are of concern to elders.

Rennel is a large island with limited areas for cultivation around the lake due to environmental limitations (mostly very rocky land). Taro is a key crop but is being threatened by disease — possibly *aloma*.

Culturally specific approaches to assistance for rural livelihoods are needed for Rennel and Bellona.

1.4.7 ISABEL — MODERATE STRESS

Isabel is a sparsely populated province. Farming systems are fairly typical of much of SI. Notable variation is in the Isabel highlands in the Maringe

district and down to Kaivanga. This is a bush village area with moderate land pressure. An interesting variation to local farming systems is the large-scale planting of 'grere' (*Saccharum edule*) after the harvest of sweet potato. This is used to add value to fallow vegetation. Grere is then harvested for the next two to three years as the garden returns to fallow providing a very important seasonal source of food from January to April. There are about six cultivars of grere, making this area probably the most important and diverse area of production of this crop in SI. In the Maringe district highlands, fallows last between four and seven years, and land use is intensifying rapidly in some areas. This is a productive higher altitude environment for niche crops, and kava, strawberries and peanut butter have all been produced, although access to markets is very difficult.

Isabel was the focus of large-scale logging during the ethnic tension period and the longer-term ramifications of this on subsistence food production are not known. There were 14 logging operations in 2002 and logging resources are now almost exhausted.

Southeast Isabel has a similar environmental limitation to southeast Choiseul with dense eucalyptus vegetation and poor soils. There are plans for nickel mining on an island off southeast Isabel, which could increase stress. Southeast Isabel also has a higher infant malnutrition problem, according to nurses who work there. Few green vegetables are grown in local gardens, for unknown reasons.

1.4.8 WESTERN PROVINCE — MODERATE STRESS

Western Province is made up of a diverse range of islands with different environments, ranging from volcanic islands to small raised coral islands within lagoons. Farming systems are typical of SI. A notable exception is the large number of ngali nuts cultivated and processed through baking in motu in this province — particularly in Kolombangara, New Georgia and Ranonga, but also in most other areas of the province.

Areas of stress occur on the small islands, including Simbo, and in Roviana, Vonavona and Marovo lagoon. There is population pressure around

Munda, although the soil is fertile. Munda area suffers from an unusually advanced trend of urbanisation which prevents many families from being involved in agriculture and hence leaves them more vulnerable to shocks in the cash economy.

Access to markets is a key constraint for more isolated parts of the province, including Marovo lagoon and Rendova. Regular scheduled ships have allowed a lifeline to some communities in Marovo to sell produce, but the collapse of the provincial shipping company has made services irregular and more difficult to target for ship-side marketing. Extensive logging in Marovo and throughout Western Province will limit future livelihood options in what was previously an extremely productive and land-rich environment.

Scattered tourism ventures and a number of commercial centres mean that Western Province has more market opportunities for subsistence produce than most provinces. But sea transport by outboard motor is a severe constraint on any economically viable marketing.

Gilbertese settlements on Gizo and in the Shortland Islands are particularly vulnerable to stress, because of limited land and poor nutrition. There are also settlements of other island groups on Gizo, which add pressure to an already fairly degraded agricultural environment.

1.4.9 CHOISEUL — LOW STRESS

Choiseul is a sparsely populated province similar to Isabel. There are three main population centres at Sasamuqa, Pangoe and around Wagina. All these areas suffer from localised land pressure. Strangely, Taro (the provincial capital and the region's only urban centre) is not located close to any of these population centres, so transport costs are a severe constraint on delivery of any services in Choiseul.

Other parts of Choiseul have abundant land and generally productive farming systems, although Choiseul generally does not have the rich volcanic soils found in Western Province. Gardens are larger because of a lower average yield than in Western Province. Sweet potato dominates but large amounts of taro, yams and other crops are also grown.

Choiseul gardens are less segregated than in some other provinces and are generally interplanted with various secondary crops, making a diverse farming system.

In the southeast, there is an unusual soil type dominated by a hardwood tree species related to eucalypts. While potentially very valuable, this land system is unsuitable for agriculture, creating the potential for land shortages in the future (although this is unlikely for the time being).

Much of Choiseul is under logging operations. The consequences have been typical: community disputes, destruction of rivers, siltation, and the need to buy building materials in the postlogging period. Another side effect is wild pigs, which are a big problem in many areas because they destroy root crop gardens. Many people report that commercial logging in the interior has driven the pigs into garden land to look for food.

The Gilbertese settlement at Wagina is particularly interesting. In this settlement, three large villages have only a limited area of land for food production. They have adopted Melanesian-style farming practices combined with traditional cultivation of *kakake*. Land will undoubtedly become an issue, although the soil is fertile. More intensive farming systems would help this area. Wagina has serious nutrition problems typical of Gilbertese settlements, with very high consumption of processed foods, sugar and oil.

Both Choiseul and Western Province have potential future markets and trade opportunities in Bougainville. Small-scale informal trade with Bougainville occurs in fish, taiyo, shell money, betel nut, store goods and even outboard motors coming back into SI.

1.4.10 MALAITA AND TEMOTU ATOLLS — HIGH STRESS

Atoll groups are found to the north in Malaita Province, including Ontong Java and Pelau, the Sikiana group to the east and Anuta in Temotu Province to the southeast.

These are extremely isolated and vulnerable environments; however, their isolation has strengthened traditional practices and coping mechanisms. Swamp taro and *Colocasia* taro are grown in mulched swamp pits supplemented by coconuts and breadfruit. There have been numerous reports of a taro disease affecting taro production, with some reports claiming this is the result of salt water inundation. All these atoll groups already have large populations in urban centres and some in other settlements. Clearly, these are sensitive environments under high stress.

2 Livestock development

SUMMARY

This chapter presents an overview of livestock production in Solomon Islands (SI), divided into two sections. The first section (Section 2.2, *Current state of livestock production and opportunities for interventions*) presents information on the current state of the livestock sector and opportunities for interventions that will improve the livelihoods of rural families. Suggestions for early, medium-term and long-term donor assistance are made. These include:

Potential early interventions:

- > developing cost-effective feeding strategies for pigs and poultry through research
- > helping to establish a commercial feed mill to provide local feeds for pigs and poultry
- > providing safe slaughtering facilities for pigs and poultry
- > providing a CEMA livestock marketing officer to help with sales and marketing
- > reviewing the beef sector to develop a strategy to re-establish the sector.

Potential medium-term interventions:

- > developing appropriate extension materials for subsistence and commercial pig, poultry and honeybee farmers
- > providing training and supporting initiatives for small-scale commercial pig, poultry and honeybee farmers.

Potential long-term intervention:

- > re-establishing both large-scale and smallholder commercial beef sectors by encouraging long-term commercial investment.

The second section (Section 2.3, *Livestock production*) provides an overview of production systems, health status, in-country research and previous donor support for livestock. This section is designed to inform technical specialists of the potential and limitations of the livestock sector.

2.1 INTRODUCTION

Village livestock production has been a component of farming systems in SI for thousands of years and contributes to the food security, cash income and cultural status of the rural population. In recent times, the smallholder sector has contributed significantly to the country's commercial requirements for pigs, poultry and honey, and to a lesser extent, beef. The ethnic tension of 1998–2003 severely disrupted livestock production and the sector has only recently started to rebuild. Before the ethnic tension, there were approximately 53 000 rural families in SI, of whom 60% owned 5–20 chickens and more than 50% owned 1–5 pigs. Conservative estimates of total livestock populations were 160 000 village chickens and 65 000 village pigs. In 2002, agriculture contributed US\$51.8 million to real gross domestic product (GDP), of which livestock contributed 30%

(Central Bank of Solomon Islands 2003). Today, approximately 85% of the population is involved in some form of livestock production.

A substantial quantity of meat products is currently being imported to satisfy demand in Honiara and in the provincial capitals. In 2003, imports of beef, pork and chicken products into Honiara were estimated to be 250 tonnes, 166 tonnes and 200 tonnes, respectively.² Thus there is an opportunity for smallholder and village-based farmers to significantly increase their contribution to the country's demand for livestock products through small to medium-scale commercial, and improved, subsistence production systems.

This chapter has two components. The first component (Section 2.2, *Current state of livestock production and opportunities for intervention*) describes the current state of the livestock sector and opportunities for interventions to improve the livelihoods of rural families. The study team gives suggestions for early, medium-term and long-term donor assistance. The second component (Section 2.3, *Livestock production*) provides an overview of the production systems, health status, in-country research and previous donor support for livestock in SI. It is designed to inform technical specialists of the potential and limitations of the livestock sector in SI.

2.2 CURRENT STATE OF LIVESTOCK PRODUCTION AND OPPORTUNITIES FOR INTERVENTIONS

This section describes the current state of the livestock sector in SI. Opportunities for improving the livelihoods of rural families are given, including suggestions for short, medium and long-term donor assistance.

SI has a long tradition of village-based livestock production, mainly pigs and poultry, and priority should be given to supporting these subsectors ahead of beef cattle and other livestock subsectors. Despite dramatic disruption during the ethnic tension, many of the pig and poultry producers are re-establishing their operations following the

restoration of law and order and market demand.

The cost of imported feeds is a major impediment to the rebuilding of these intensive industries. This impediment needs to be addressed by using locally available feeds and byproducts, and re-establishing a local feed mill. There are opportunities to develop the pig and poultry industries by improving subsistence production for local consumption and sale, developing small-scale commercial production to supply Honiara and the provincial capitals and subcentres, and developing medium and large-scale production that is based on Guadalcanal, (and to a lesser extent the surrounding provinces), to provide the bulk of supplies into Honiara. Opportunities for livestock development in the politically sensitive region of the Weather Coast of Guadalcanal are limited.

The beef cattle sector has almost ceased to function since the ethnic tension and requires a long-term approach to reconstruction. The sector is unlikely to impact large numbers of smallholder beneficiaries as it requires comparatively large areas land to form a viable unit. The sector is important for reducing imports of beef. Honey production has been set back by the invasion of the Asian bee into Guadalcanal, but there is potential for its development in remote provinces, such as Rennell and Bellona, and for continued assistance on Malaita. Potential interventions for improving the livestock sector are presented below by livestock type and by timeframe.

2.2.1 SUBSISTENCE LIVESTOCK PRODUCTION

The following paragraphs explain how subsistence production can be improved for pigs, poultry, beef cattle and honeybees.

Pigs

Pig production offers the greatest potential opportunities for income generation in the smallholder livestock sector. The smallholder sector should therefore be a focus of early donor assistance. Pigs are currently in short supply across SI, but their high reproductive rates mean that pig numbers can be increased rapidly.

² Figures are estimates only, based on interviews with Department of Agriculture and Livestock staff and Honiara meat importers.

Improving subsistence production

The productivity of pigs in subsistence systems can be dramatically improved through attention to feeding, breeding and hygiene management. The Kastom Gaden Association (KGA) has effectively used a ‘benchmarking’ approach, where successful local pig producers demonstrate what can be achieved with good management. Benchmarking has the advantage of providing technology from within the community, using local inputs that are proven in the local environment, and components of commercial systems may be added, where appropriate. For example, good-quality crossbred pigs grow more quickly than native pigs. The strong, informal markets for pigs in the provinces would be the primary source of sales, with significant sales of weaners (weaned pigs of 8–12 weeks of age) at 8–12 weeks. A number of pigs could also be properly fed through to slaughter weight. Porkers (pigs produced specifically for meat production) can also be readily sold throughout the provinces, and because pigs can be transported relatively easily by ship, they can also be sold in Honiara.

BOX 2.1 PIGS: OPPORTUNITIES FOR ASSISTANCE 1 (PRODUCTIVITY)

Improve the productivity of pigs in subsistence systems throughout SI by:

- > initiating a process of benchmarking to identify the production potential within communities
- > providing technical information on husbandry and feeding systems through farm visits and appropriate written materials
- > providing regular follow-up visits by technically competent field staff
- > helping to link subsistence production into commercial production where appropriate.

Improving small-scale commercial production

Training and technical support can potentially support the small-scale commercial piggery subsector to supply meat to the provincial centres and areas of development (provincial capitals, schools etc), and weaners to local villagers. Training could help farmers to rely on local feeds rather than purchased feeds. Small-scale commercial pig

farmers will need regular technical support during the establishment phase to ensure that breeding and feeding management is appropriate. These small-scale producers will need a thorough understanding of their market so they can meet periods of high demand, such as Christmas. Engaging a livestock marketing officer within the Commodities Export Marketing Authority (CEMA) would help sales and marketing.

BOX 2.2 PIGS: OPPORTUNITIES FOR ASSISTANCE 2 (SMALLHOLDER PARTICIPATION)

Improve participation of smallholder pig farmers in supplying commercial markets in the provincial capitals and Honiara by:

- > researching and developing improved, cost-effective feeding strategies
- > providing technical information on husbandry and feeding systems through short courses, benchmarking, field visits, technical notes and posters
- > providing regular follow-up visits by skilled field staff
- > facilitating communication between suppliers and buyers for improved marketing
- > providing training in business management specifically related to pig production.

Improving medium-scale commercial production

Most producers involved in the medium-scale commercial subsector are based on Guadalcanal and Malaita and will not need production-related assistance to re-establish their commercial operations. However, they will need help to regularly introduce new genetic stock, ensure quarantine is sufficiently robust to exclude exotic pests and diseases, and to minimise the negative environmental impacts of intensive peri-urban farms. Of major concern is the treatment of effluent disposal from piggeries to ensure that it does not pollute streams and watercourses. Medium-scale producers in Guadalcanal and Malaita will also need training and assistance in marketing and financial management.

BOX 2.3 PIGS: OPPORTUNITIES FOR ASSISTANCE 3 (MEDIUM-SCALE PRODUCTION)

Re-establish medium-scale pig production units on Guadalcanal and Malaita by:

- > researching and developing improved, cost-effective feeding strategies
- > providing information on feeding strategies using locally available feeds and byproducts, and imported supplements
- > helping to establish a commercial feed mill to provide local feed
- > helping to establish registered slaughterhouses and provide a fee-paying meat inspection system
- > determining minimum standards for effluent management and training producers to meet these standards
- > providing effective quarantine to prevent the entry of exotic pests and diseases and enabling the importation of semen for improved breeding lines
- > helping communication between suppliers and buyers for improved marketing
- > providing training in business management specifically for pig production.

Poultry

Improving subsistence production

There is considerable potential for promoting the use of village chickens and dual-purpose birds for meat and egg production through local feeds, improved management and appropriate housing. Improved village systems do not require substantial cash outlays for feeds, and production is staggered, allowing regular sales of eggs and meat birds. Local materials are appropriate for building cool, well-insulated coops. There is a clear role for poultry extension specialists from the Department of Agriculture and Livestock (DAL) and nongovernment organisations (NGOs) to conduct benchmarking and training using good-quality extension booklets and posters. The KGA were reasonably effective in operating with young poultry producers on Choiseul and Malaita, and lessons can be learnt from their experiences. In particular, regular follow-up visits are an essential component of village-level assistance. Producers should be trained to negotiate cultural and family demands

to provide birds for slaughter without unduly diminishing breeding stock requirements.

BOX 2.4 POULTRY: OPPORTUNITIES FOR ASSISTANCE 1 (PRODUCTIVITY)

Improve the productivity of subsistence poultry systems throughout SI by:

- > starting a process of benchmarking to identify the production potential within communities
- > providing technical information on husbandry and feeding systems through farm visits and appropriate written materials
- > providing regular follow-up visits by skilled field staff
- > linking subsistence production into commercial production where appropriate.

Improving broiler and layer chicken production

There is little point in supporting commercial broiler (meat production) and layer (egg production) units based on hybrid birds, because of the absence of a local feed mill and the high cost of imported feeds. Hybrid poultry are highly responsive to feed quality and will rarely deliver a satisfactory return on investment when fed low-quality feeds. The Australian Centre for International Agricultural Research (ACIAR) is currently negotiating a project with DAL and NGOs to investigate local feed sources for both commercial and village chicken production. One of the local commercial feed mills needs to re-open to supply the local market, and this is likely to happen soon if the market looks favourable. Donors may be able to speed up this process by providing start-up incentives.

Support for high-input commercial broiler and layer farms could be considered once high-quality feeds are available locally at a reasonable price. Support would consist of practical training in broiler and layer production and marketing, as well as financial management of high-input broiler systems. Developing small-scale broiler and layer farms has most potential on Guadalcanal, close to the larger provincial centres and where there are freezer and transport facilities. There is a clear role for DAL and NGO poultry experts to provide training and regular follow-up visits. Good-quality extension booklets

and posters are needed to accompany training. The European Union (EU)-funded broiler projects should be revisited to assess the need for further training and technical assistance.

Honiara's table egg market will be dominated by the Tong Corporation's layer farm for the foreseeable future, and the potential for other medium to large-scale operations is unclear. Medium-scale broiler producers are likely to respond independently to input and sales price signals. However, technical assistance from DAL and NGO poultry experts will be necessary to help disease diagnosis and control, feeding management, and importation requirements of medium-scale producers.

BOX 2.5 POULTRY: OPPORTUNITIES FOR ASSISTANCE 2 (PARTICIPATION)

Improve participation of smallholder poultry farmers in supplying commercial markets in the provincial capitals and Honiara by:

- > providing technical information on husbandry and feeding systems through short courses, benchmarking, field visits, technical notes and posters
- > providing regular follow-up visits by skilled field staff
- > facilitating communication between suppliers and buyers for improved marketing
- > providing training in business management for poultry production.

BOX 2.6 POULTRY: OPPORTUNITIES FOR ASSISTANCE 3 (MEDIUM-SCALE PRODUCTION)

Re-establish medium-scale poultry production units on Guadalcanal by:

- > helping to establish a commercial feed mill to provide local feed
- > helping communication and understanding between suppliers and buyers
- > providing training in business management specifically related to poultry production
- > providing an effective quarantine system to prevent the entry of exotic pests and diseases.

Beef cattle

Cattle production can give high returns; however, sales and income are irregular because of the long-term nature of production. Cattle production on Guadalcanal was largely destroyed by the ethnic tension and has failed to return on a significant scale. Because of this, there are no functioning systems for sales from remaining cattle herds. The beef industry needs a long-term reconstruction plan to achieve its potential in SI. A key to future success will be the establishment of several medium to large-scale production units that will interact to support the smallholder sector. The remnants of the beef industry should be supported as the foundation of future growth. Because the beef sector will involve fewer smallholders than pigs and poultry, it should be a lower priority for development assistance.

In the provinces, a communication network among producers and buyers is urgently needed. This network could be set up by DAL, NGOs or by the local butchery managers, with assistance from the proposed CEMA marketing officer. Good communications among producers would make best use of good-quality bulls. A major limitation to current production is lack of access to good-quality bulls. More effective collaboration and communications among producers would go some way to overcome this constraint. Good communication would also enable some planning in sales and culling. High-quality extension materials might be obtained from Vanuatu. Small-scale slaughtering and meat inspection facilities, and training in financial management of smallholder beef cattle operations, are also essential.

As medium to large-scale producers re-enter beef production, there will be opportunities to encourage their interaction with smallholder producers. This interaction will maximise benefits: smallholders can benefit through sharing bulls, handling facilities and inter-island transportation opportunities (via barges), while ranchers can benefit from good relations with landowners and sales of weaner cattle for fattening.

BOX 2.7 BEEF CATTLE: OPPORTUNITIES FOR ASSISTANCE 1 (SMALLHOLDER PRODUCTION)

Re-establish smallholder cattle production in provinces for supplying beef to commercial markets in the provincial capitals and Honiara by:

- > helping to set up networks of provincial cattle farmers
- > providing appropriate training and extension materials, and using capacity and resources in Vanuatu
- > helping communication between suppliers and buyers for improved marketing
- > providing training in business management for beef cattle production
- > assisting positive interactions between large estate producers and smallholders
- > providing an effective quarantine system to prevent the entry of exotic pests and diseases.

BOX 2.8 BEEF CATTLE: OPPORTUNITIES FOR ASSISTANCE 2 (MEDIUM TO LARGE-SCALE PRODUCTION)

Re-establish medium to large-scale cattle production units on Guadalcanal and other provinces by:

- > reviewing the beef sector to determine opportunities for establishing medium to large-scale cattle production units
- > concentrating on the availability of alienated land,³ access to markets and opportunities to support the smallholder sector.

Honeybees

Increasing smallholder participation in the bee industry would require cash or equipment for start-up (about US\$2500 per farmer); training in apiculture techniques; timely follow-up with technical assistance; access to markets; and access to bees and equipment (pers comm Peter Hardie, CUSO volunteer, 2004). Development activities should be focused on Malaita, where honey production is currently centred, as well as in disadvantaged regions with few alternatives for income generation. These regions include Rennell and Bellona Province, and the Weather Coast of Guadalcanal (depending on the status of the Asian bee).

BOX 2.9 HONEY: OPPORTUNITIES FOR ASSISTANCE 1 (PRODUCTION)

Support the continued development of honey production for supply of local and export markets by:

- > providing training through the Department of Agriculture and Livestock (DAL), Rural Training Centres (RTCs) and NGOs, using appropriate extension materials
- > providing support to DAL, RTCs or NGO experts to undertake field support and follow-up training of existing producers
- > providing short-term support to the Honey Association to enable it to rebuild following the ethnic tension.

Other livestock

Other livestock in SI include goats, horses and ducks. They are not covered in this document, because their contribution to rural livelihoods is negligible, and their immediate prospects for development are limited.

2.2.2 TIMING AND LOCATION OF POTENTIAL INTERVENTIONS

Because of the political importance of the Weather Coast of Guadalcanal and Malaita, the study team considered these regions separately in this chapter. In general, provinces should be considered on an individual basis to make best use of existing opportunities, and some attempt has been made to identify these in the provincial reports, although more detailed investigation is required for project design. Further investigation is also needed into the commercial beef sector, because its specific requirements are outside the scope of this analysis.

Weather Coast of Guadalcanal

There is limited scope to develop livestock industries on the Weather Coast of Guadalcanal. The region has no comparative advantages for production, and has obvious disadvantages in market access as well as an extremely wet climate. Subsistence systems for pig and poultry production could be improved, but identifying markets for surplus production will limit sustainability. If incomes can be increased outside

³ Alienated land is land taken over by colonialists historically and now not belonging to any specific tribal group.

the livestock sector, there may be potential for more sales within the region.

In contrast, there may be potential to develop honey production on the Weather Coast. Honey stores well, is easy to transport and is of relatively high value; however, the Asian bee is currently damaging hives on the Guadalcanal Plains, and the potential for invasion and subsequent production losses on the Weather Coast needs investigation.

Malaita

Malaita has a long history of livestock production and there are regular shipping services to the Honiara markets. Thus there are significant opportunities for developing pig, poultry, beef cattle and honeybee production on Malaita. The first priority should be given to the small-scale commercial production of pigs, followed by poultry and honey (see the sections above on 'opportunities for assistance'). Priorities are based on the traditional and recent expertise of Malaitans in pig production, the potential to utilise a proportion of local feeds in viable production systems and the relatively easy access to the Guadalcanal market.

Interventions by timeframe

The following sections provide general information on beef, pork and poultry production in these regions, including early, medium, and long-term interventions. AusAID has identified some interventions in production systems to improve the livelihoods of rural families. Some of these interventions can be addressed immediately; however, medium and long-term approaches are required to address more complex issues. Sustainable improvement of subsistence livestock systems should be considered as a long-term undertaking and is unlikely to be achieved through short-term inputs.

Early interventions

Developing local feeds

The proposed Australian Centre for International Agricultural Research (ACIAR) project should incorporate a component to develop pig feeds based on local feeds and byproducts. The project should

include further components for the production of posters and pamphlets promoting the new feeding strategies and short-term training of key personnel from RTCs and NGOs. The potential for production of livestock feeds through a local mill should also be investigated, and incentives for private sector involvement may also be appropriate.

Providing safe slaughtering facilities

Slaughter facilities are required so that livestock slaughtering and meat marketing can be done safely and comply with the SI Pure Food Act 1996. This requires establishing small slaughter facilities on Guadalcanal, Malaita and possibly other islands, and engaging meat or health inspectors on a fee-for-service basis to oversee attention to safety and hygiene.

Engaging a CEMA livestock marketing officer

Engaging a livestock marketing officer within the Commodities Export Marketing Authority (CEMA) would help sales and marketing. Since the abattoir was destroyed during the tension, there has been no centralised point for sale of livestock, and both selling and purchasing is currently a haphazard process. A livestock marketing officer would provide a weekly radio bulletin of supplies and prices received in Honiara, and help producers and buyers of livestock to communicate with each other.

Reviewing the beef sector

Local production can meet the strong demand for beef, providing there is a viable commercial sector, supported by an active smallholder sector. A review of the beef sector (both smallholder and commercial) is required to plan its re-establishment. To attract high-quality investors to the market, suitable parcels of alienated land need to be identified where neighbouring landowners are supportive of large-holdings. Affordable transportation and slaughtering facilities need to be developed. Processes that involve smallholder beef producers in the industry need to be determined. The DAL Livestock section will be important contributors to the review process of the whole beef sector, as staff have considerable knowledge of both commercial and smallholder subsectors.

Medium-term interventions

Developing extension materials

Extension materials should be produced to achieve a widespread understanding of improved techniques for livestock production. These materials would need to be developed with external or additional technical assistance (TA). The TA would make best use of existing materials from Vanuatu, Papua New Guinea (PNG) and SI. The Integrated Agricultural Training Program from PNG could potentially provide useful support, such as booklets, pamphlets and posters, produced according to the most effective method of presentation. This written material is required to improve pig and chicken feeding using local feeds, managing pig breeding, raising dual-purpose chickens, developing business approaches to livestock marketing and safe practices for slaughtering village livestock, and many other topics. Topics should be determined and prioritised in consultation with local experts, and should make use of extension materials available in PNG, Vanuatu and other Pacific countries. To help develop written material, one SI livestock extension specialist and one SI information specialist should be engaged over a two-year period, with 12 months' input from an Australian-based livestock information specialist.

Providing training

Training should be provided to farmers to improve the productivity and economic viability of small-scale commercial and subsistence pig and chicken production. A program would be coordinated by DAL or the KGA and delivered through the RTCs, with inputs from DAL livestock specialists and private SI livestock production specialists. Preliminary efforts could target small-scale commercial operations on Guadalcanal and Malaita. The training program would be designed and written by DAL staff with four to six months' assistance from an Australian or PNG-based livestock production specialist. Follow-up of participants following training will be required and the training program should continue over a three to five-year period.

Long-term interventions

Re-establishment of the beef sector

The beef cattle sector review will outline a long-term plan for re-establishing the sector. Successful implementation of the plan will require a long-term vision, taking care to avoid the mistakes of previous beef sector interventions. In particular, it will engage medium to large-scale private investment to provide stability and efficiencies of scale to the sector.

The impact of the ethnic tension

The most dramatic effects of the ethnic tension were experienced on Guadalcanal, where the bulk of the commercial livestock sector was based. Commercial production facilities were largely destroyed in the violence. The DAL's Dodo Creek Research Station was also destroyed, along with the majority of the breeding herds of cattle and pigs. The Livestock Development Authority's feed mill was destroyed and there is currently no feedmill preparing poultry feeds. Importantly, the country's only abattoir, an EU-accredited facility, was destroyed during the ethnic tension. Large amounts of meat products are being imported to satisfy local demand, including 250–300 tonnes of beef annually.

Malaita has long been an important source of livestock for the Honiara market, particularly for pigs but also for broilers, table eggs, beef and honey. Malaitan livestock producers had to shut down or greatly reduce the scale of their operations during the ethnic tension because of the downturn in demand. With the restoration of law and order and the presence of a large expatriate community, demand has returned to pre-ethnic tension levels and Malaitan producers are responding accordingly. The pig supply from Malaita is now 20–30 pigs per week and supplies of chickens are also increasing.

In Central Province, Russell Island Plantation Estates Ltd (RIPEL) has been affected by the ethnic tension, in addition to a long-running industrial dispute. Consequently, their 30-sow piggery is being progressively closed, the cattle herd has not been managed for several years, and the slaughter facility is not in use. The dispute must be resolved before the supply of livestock is restored. Livestock production in the outer islands was largely

unaffected by the ethnic tension, because there was relatively little product sold into the Honiara market.

Slaughter facilities and the Pure Food Act 1996

There is currently no large-scale slaughter facility in SI, after the Honiara abattoir was destroyed during the ethnic tension. Livestock sold into Honiara are bush killed, packed on ice and delivered to the local butcheries as gutted carcasses. A Pure Foods Act is currently before parliament, and would make such practices illegal. The current alternative is to use several small-scale slaughter facilities that exist around the country, in combination with trained meat inspectors, to ensure that hygienic practices are followed. SI is fortunate to have about 10 meat inspectors trained in either Australia or PNG. Some of these slaughter facilities will require refurbishment, and most will need to have chiller units installed, so that the carcasses can be chilled before transportation. Killing could be done on a fee-for-service basis.

Quarantine

Maintaining the relatively disease-free status of SI livestock is paramount. This requires a strong quarantine service backed up by early warning of disease outbreaks. The most recent animal disease surveys were done by the Secretariat of the Pacific Community (SPC) in 1999. At that time, SI was free from the World Organisation for Animal Health (OIE, formerly the Office International des Epizooties) List A diseases of livestock (diseases that have serious socioeconomic or public health consequences). The Quarantine Inspection Service currently relies on exporting countries to provide the necessary certifications of disease free status. Because of the breakdown of quarantine systems during the ethnic tension, it is imperative that an up-to-date livestock disease survey is undertaken, and that quarantine protocols and procedures are revised to ensure their current effectiveness. For example, the Asian bee (*Apis cerana*) is believed to have entered SI via the Honiara port during the ethnic tension. The bee's dramatic effect on hives in Guadalcanal meant that it was rapidly detected, but was unable to be eliminated. There are also pests and diseases of livestock present in

neighbouring PNG, but not in SI at the time of the 1999 survey. Therefore, a livestock pest and disease survey to clarify the current status should be given high priority. Diseases listed as being of particular importance with respect to SI livestock industries are:

- > rabies
- > vesicular diseases
- > Newcastle disease
- > avian influenza
- > tuberculosis
- > brucellosis
- > classical swine fever
- > African swine fever
- > Aujeszky's disease
- > ticks
- > tick-borne diseases (anaplasmosis)
- > bovine pestivirus
- > transmissible gastroenteritis
- > porcine respiratory and reproductive syndrome
- > virulent infectious bursal disease
- > caprine arthritis/encephalitis.

Technical and infrastructure support capacity

The primary capacity to support livestock development activities exists in DAL, RTCs and various NGOs. Some capacity to produce appropriate, high-quality extension materials exists within these organisations, but would ideally be coordinated by a recognised expert. The following sections outline the technical and infrastructure support capacities of DAL, RTCs and NGOs.

Department of Agriculture and Livestock

Human resource capacity within DAL includes three specialist research staff based in Honiara, and generalist extension staff based in the provinces. Specialist staff include Nichol Nonga (pigs and poultry), Barnabas Keqa (cattle), Peter Haeo (apiculture) and Lusman Alikona (apiculture). Currently, DAL does not employ a veterinarian. Specialists are generally well trained and possess good practical skills, but regular upgrading of skills is required. They have previously played

an important role in developing and multiplying breeding stock for distributing to the provinces. Importantly, there are no graduates ready to replace older staff as they retire.

There are about 150 generalist agricultural extension staff located in the provincial capitals and substations, although numbers will soon be reduced to about 100 staff. The main provincial station generally includes one livestock extension officer (in seven of the nine provinces), while the substations around the provinces have generalist staff. Capacity for both specialist and generalist staff to service their farmer clients is limited due to funding and equipment shortages. National laboratories and field research stations were largely destroyed during the ethnic tension and are unlikely to be rebuilt in the near future. Provincial staff are faced with crippling fuel and transport shortages and inadequate or nonexistent extension materials. As a result, staff generally limit their activities to directly funded donor activities (such as rice development, funded by Republic of China (Taiwan), selecting recipients of Community Peace and Restoration Fund (CPRF) copra dryers, or selecting recipients of EU Micro Projects).

Most staff in DAL are willing to become engaged in funded activities supporting their rural communities. Programs that encourage strong synergistic linkages between DAL, RTCs and NGOs would be useful to achieve this.

Rural training centres

Rural training centres (RTCs) arose from church, community and donor-assisted programs over many decades, and there are now 34 RTCs in eight provinces. Since 1982, they have loosely amalgamated as the Solomon Islands Association of Rural Training Centres (SIARTC). The RTCs are currently being supported by the EU to improve the standard of their agricultural training. RTCs generally have extensive farm lands from which they produce a percentage of their food needs. RTCs may potentially be used to deliver training in livestock production to students (through conventional scholarship programs), and neighbouring villagers (through short course programs).

National government organisations

There are several national and provincial NGOs with capacity in livestock production and development. The Kastom Gaden Association (KGA) is the best known of these, although it currently only runs livestock programs in Choiseul and Malaita. The KGA works with improved subsistence production systems and provides a good basis upon which to develop future programs. Networks with DAL, RTCs and other NGOs will be required, because the KGA has limited capacity to expand its operations. Most provinces have women's groups and farmers' associations with the potential to organise livestock development activities. Livestock specialists would need to be sourced from DAL or RTCs to ensure that the required technical capacity is provided (DAL has livestock specialists who could conduct specify training components, while RTCs have more generalist trainers).

Boxes 2.10, 2.11 and 2.12 below provide case studies of small and medium-scale piggeries, and a butchery in SI. The case studies identify potential opportunities for assistance to improve livestock production, processing and support.

BOX 2.10 CHARLOTTE AND MOSES MASUGURIA, SMALL-SCALE PIGGERY — MANIBENA, MAKIRA

Charlotte and Moses Masuguria started a European Union (EU)-funded piggery at Manibena in late 2003. The project supplied 10 weaner piglets, 5 sows and a boar. Charlotte and Moses fattened and sold their weaners as porkers of 60+ kg liveweight into Honiara. Freight was \$90/head and they received \$20/kg carcasses weight (about \$800 each) for the pigs upon sale to the Honiara butchery. Four of their sows have recently produced 30 piglets, one of which has died. Some of the piglets will be sold locally as eight-week-old weaners (8–10 kg liveweight) for \$200 each. The rest will be fattened and sold as porkers, either locally to the Kirakira butchery, or into Honiara.

The cost of imported feed from Honiara is the main impediment to profitability, and Charlotte and Moses intend to investigate local feeds. This requires information about effluent management, and the use of effluent to grow feed crops. Imported feed costs around \$140/40kg bag delivered and shipped, and delivery can be unreliable. However, mill run can be purchased for \$29/40 kg, and coconut meal is now available from the micro-expeller factory at Tawani. A range of cooked root crops will be used to supply digestible energy. Protein requirements will be largely met through fishmeal imported from Honiara. Charlotte and Moses would like to investigate the use of high-quality legumes as a protein source in the future.

The pigs are fed by Moses and his daughter during the week, and by Charlotte and their other children on the weekends. Charlotte and Moses want to learn more about breeding management, such as weight and age, before joining gilts to boars. They would also like to undertake a financial analysis of the project to determine profitability of different feeding and selling systems, and of the viability of selling weaners compared with selling porkers.

BOX 2.11 JOHN AND ERIA KABWERE, MEDIUM-SCALE PIGGERY — WHITE RIVER, GUADALCANAL

John Kabwere and his family run a medium-scale piggery at White River in peri-urban Honiara. The herd comprises seven sows and one boar, and is being rebuilt after significant losses were experienced during the ethnic tension. The unit will ultimately run 30 sows. Weaners are sold to local farmers for around \$150 each. Porkers are sold to Sullivan's butchery or to local people putting on feasts.

Feeds are mixed on the property and consist of 10% fishmeal, 30% mill run, 40% copra meal, and 15% spent brewer's grain and micronutrient/amino-acid mix. Spent brewer's grain is purchased for \$50/0.5 tonne, or \$100/3 tonnes, but must be dried to prevent spoilage. Growers gain about 400 g/day.

Breeding stock were purchased from the Livestock Development Authority (LDA) and are crossbreeds based on large-white, duroc, landrace and native pigs. Genetics is maintained through the use of good-quality boars from neighbours and occasional purchases. Sows have litters of 12–14 piglets, of which 10–11 piglets usually survive. Runts receive no special treatment and generally gain weight rapidly once weaned. Piglets are weaned at 6–8 weeks at a weight of 8–10 kg. The pigs rarely get sick but occasionally suffer from intestinal parasites and skin diseases. These ailments are treated with locally available medicines.

The family has also raised broilers, but considers pigs to be more financially rewarding. Substantial losses of broilers occasionally occur due to fowl pox. Effluent is drained into a pit, around which bananas are grown. Further work will be required to manage effluent once John and his family have a complete herd.

BOX 2.12 MOSES OLI, LOCAL BUTCHERY — KIRAKIRA, MAKIRA ISLAND

Moses Oli, a young local entrepreneur from Waimapura, has leased the Kirakira butchery from the Makira Provincial Assembly on a monthly basis since May 2004. The butchery consists of a kill floor, two large chest freezers, and a nonoperational coldroom. Moses is the fourth businessman to run the butchery, which had not been functioning for several years. While the butchery was nonfunctional, there was no outlet for locally produced cattle — a factor contributing to the failure of the local beef industry.

The butchery processes around three head of cattle, between one and three pigs, and up to 50 chickens each month for local sale. Beef is the most prized meat, because it is the least available type of meat within the villages. Steers or bulls of 1.5 to 2 years of age are purchased for around \$1500/head. These produce carcasses of around 200 kg, indicating liveweights of about 380 kg. Makira is known to produce good-quality beef, largely because of the ample supply of para grass pastures left from the Livestock Development Authority (LDA) days. Meat is sold in 500 g lots for \$30–\$50/kg, depending on the type of cut. Soup bones are sold for \$6.50/kg. There is a ready market for all classes of meat. The major problem is accessing cattle, because few are left in the area close to Kirakira. Currently, Moses travels up to 20 km to purchase stock. Cattle are killed and gutted on farm, packed on ice, and then taken to Kirakira in quarters for butchering.

Pigs are purchased at six months of age, predominantly from European Union (EU) project recipients. Locally fed pigs have a poor yield, being over-fat from their predominantly coconut-based diet. Cross-bred pigs are bought on a dressed-weight basis at \$15/kg. There are now five piggeries in the area, but not all are fully operational yet. There may be an over-supply of the market when these piggeries open. The butchery currently processes three pigs per month. Five fully operational six-sow units could easily produce 40 weaners per month. There is a considerable market for live pigs, but the extent to which this will account for this extra production is unknown.

Processing chickens through the butchery is somewhat haphazard and is done as a service, rather than as a commercial operation. Broilers purchased from EU operations at \$40/bird are sold as chicken pieces. Local chickens are purchased for \$15–20/bird and are sold frozen at \$35/bird. These are often purchased in relatively large numbers (up to 50 birds) from individual farmers wanting cash. Local broiler farmers are worried about the demand for their product, because the viability of these enterprises (depending on imported chicks and feeds) declines rapidly if the birds have to be maintained beyond seven weeks of age.

The Kirakira butchery is a key component in the development of commercial livestock production in Makira and Ulawa provinces. The availability of local cattle and pigs, and the ability to supply meat into Honiara, would ensure the financial viability of the butchery. Negotiations are already under way to provide pork to Sullivan's Butchery in Honiara. Carefully targeted donor assistance will help to establish viable smallholder cattle and pig- production units on Makira.

2.3 LIVESTOCK PRODUCTION

This component provides an overview of livestock production systems and the status of animal health in SI. Current in-country research and previous donor assistance supporting production systems for pigs, poultry, beef cattle and honeybees are also explained. The purpose of this component is to inform technical specialists of the potential and limitations of the livestock sector in SI.

Livestock research capacity in the SI has been greatly diminished by the destruction of facilities at Dodo Creek and Tenevatu farms, and the general lack of support from both government and donors. The Department of Agriculture and Livestock's (DAL) extension system is relatively inactive due to the same lack of support. Despite this lack of support,

there is potential to link remaining capacity within DAL with capacity within RTCs and NGOs, to deliver training and support to rural communities. Quarantine and meat inspection services require urgent attention to safeguard the country from unwanted pest and disease invasions, assist the safe importation of improved genetic material, and ensure the supply of hygienic meat products to consumers.

There are numerous systems of traditional pig production, with lowest inputs required in free-range systems and highest inputs required in pen systems. Considerable opportunities for increased productivity can be achieved through the widespread introduction of crossbred pigs, construction of simple pens that can be readily cleaned to reduce worm burdens, and through improved feeding

based on local byproducts, forages and sufficient quantities of traditional feeds.

Smallholder commercial poultry production has been based on imported hybrid broilers and layers and imported feeds. These systems are of questionable economic viability. Improved subsistence systems based on dual-purpose birds fed good-quality local feeds are likely to be more profitable for village-based systems. The viability of commercial systems requires that high-quality feeds are available at reasonable prices. This will only occur when rations based on local feeds and byproducts are prepared in an in-country feed mill.

Beef cattle production has been in a state of steady decline since long before the ethnic tension. This decline is related to excessive off-take (sales or slaughter) of stock, the exit of several large companies from the subsector, and continuing land disputes on Guadalcanal. Smallholder cattle production continues at a minor level but is ultimately likely to fail due to in-breeding, very low reproduction rates and excessive off-take. A beef sector review is required to determine suitable areas of land with potential for development of medium to large-scale beef cattle enterprises on Guadalcanal and on islands within easy reach of the capital; to encourage investment from the commercial sector; and to develop a roadmap for reconstructing the beef sector to increase participation of smallholder cattle farmers.

2.3.1 PIGS

Pig production has been a component of traditional agricultural production in SI for more than 5000 years. Pig production tends to be somewhat separated from the primary crop farming systems in most regions. There is limited use of crop residues to feed pigs and their manure is rarely used for soil fertility improvement. Some villagers report the use of pigs to help dig soil in preparation for gardens, but this is not common. The 1999 census reported that approximately 50% of SI households kept pigs, but this is almost certainly an underestimate, because pig ownership fluctuates with sale and slaughter (SIG 2002). In a study of village pigs, de Frederick (1971) showed that ownership

fluctuated from 50% of households in January, to 97% of households in March, to 78% of households in September. Rapid decreases in ownership are generally related to significant customary events. Pig producers on Guadalcanal and Malaita, in particular, supply the bulk of Honiara's demand for pork, through small to medium-scale production systems.

Production systems

There are several systems of pig production in SI, including traditional, western commercial and hybrid systems. Ranked in order of increasing intensity of production, these are:

- > free-range systems
- > tethering systems
- > palisade systems
- > semi-intensive systems
- > earth-yard systems
- > slatted-floor systems
- > intensive commercial systems.

Free-range systems

The free-range system refers to the common village system today, where pigs forage freely around the villages and are occasionally fed food scraps and coconut kernel by their owners. This system is the source of constant disputes, because pigs invariably damage gardens, and are regularly killed or wounded as a result. The system does enable pigs to access water in streams, as well as a wide range of forages. It also enables pigs to mate freely.

Tethering systems

The tethering system refers to pigs being restrained by a three to five-metre length of rope tied to one leg, with the other end tied to a tree or stake to restrict the pig's foraging. Depending on the amount of forage available within the tethered area, pigs should be moved once or twice a day, and the rope should be switched to a different leg daily. Unfortunately, it is common to find tethered pigs with one withered leg caused by constriction of the blood supply over an extended period by a tight tethering rope. Under typical conditions, pigs are underfed and have little or no access to water. Breeding is rarely possible. Tethering systems were most prevalent in Temotu

at the time of de Frederick's survey in 1971, and are also common in the northern islands of Vanuatu.

Palisade systems

The palisade system refers to a practice formerly used in interior regions of Guadalcanal, Malaita and Central Province, where gardens were fenced to restrict access by free-ranging pigs. Pigs would forage freely during the day and return to their owners' houses in the evening to be fed additional rations of scraps and cooked root crops. Alternatively, wild pigs were encouraged to feed on food scraps regularly placed over the fences to make them more easily captured. The palisade system has all the benefits of the free-range system in terms of food, water and breeding, without the negative aspects of garden damage, but requires considerable efforts in fencing of gardens. It is still used in a few remote regions of Malaita.

Semi-intensive systems

In the semi-intensive system, pigs are kept in pens and are fed daily, but are allowed to forage for several hours each day. This system provides reasonable control over pigs and has the advantage that they can obtain water and additional feed, and can mate during their period of freedom. However, damage to gardens and theft are continuing problems.

Earth-yard systems

The earth-yard system refers to a fenced enclosure with an earth floor. The pens should be located in free-draining areas to stop them from becoming boggy. In 1971, de Frederick reported that 80% of pigs in SI were kept in these pens. Ideally, this is a high-input system in which pigs are well fed, have ready opportunities for mating and are unable to destroy gardens. In reality, pigs tend to suffer from intestinal worms and insufficient food and water when kept in earth yard pens. Today, the use of earth yard pens is generally restricted to the more remote communities.

Slatted-floor systems

Slatted-floor pens are used by the saltwater people of Malaita's artificial islands to keep pigs in raised pens above the sea. These are fattening systems

only, with weaners being purchased from the bush people inland. Pigs are entirely dependent on their owners for food and water. Slatted-floor pens are also used by bush people on Choiseul. Intestinal worm problems are generally low, because the pens can be easily cleaned.

Intensive commercial systems

Intensive commercial production is done by producers on Guadalcanal and Malaita who run 10–50-sow herds and regularly sell them in the Honiara market. Most are western-style operations with concrete floors, timber pens and iron roofs. Feeds generally comprise premixed rations, or individual components of mill run, spent brewers grain, copra meal, fishmeal and micronutrient mix that are mixed on-farm. Liveweight gains of crossbred growers are in the order of 450–600 g/day. Less sophisticated feeding systems based on mill run, fishmeal and local feeds are used on Malaita to achieve growth rates of 350–450 g/day. The medium-scale commercial piggery sector was largely destroyed by the ethnic tension and is slowly being re-established.

Animal health

SI is free from major diseases of pigs, including swine fever, tuberculosis, brucellosis, foot and mouth and swine vesicular diseases. Internal parasites, such as *Stephanurus dentatus* and *Metastrongylus* spp., are endemic and are the most common constraint to production. Simple measures to limit the impact of internal parasites are well known by the DAL pig production expert, but are often unknown to village-based farmers. These include providing a clean feed trough or pad, cleaning pens daily, using slatted or concrete floors rather than earth yards, and providing adequate quantities of fresh water and good-quality feeds.

In-country research

Although early cattle and poultry research almost exclusively targeted commercial expatriate production, some of the early research in pig production investigated native pig production systems. De Frederick (1971) reported great differences in feeding and husbandry among

villages, and it was shown that attention to feeding in the villages more than doubled the weight of native pigs weaned at eight weeks (see Table 2.1). European breeds were more productive than native pigs when fed grain-based diets, but were no more productive when fed good-quality local feeds. The impact of intestinal parasites was reduced by improving hygiene through the use of regularly cleaned slatted- or concrete-floor systems, rather than earth-yard systems.

Exotic pig breeds can be crossed with native pigs to produce a well-adapted crossbred pig capable of supporting twice the liveweight gain of native pigs under village conditions. Today, large-white, duroc and landrace breeds are favoured, but berkshire, tamworth and saddleback breeds were also successfully introduced. Good-quality crossbred growers can produce 600 g/day of liveweight gain, whereas native pigs have a maximum potential of around 250 g/day.

Feeding strategies to improve productivity of crossbred pigs in semicommercial village systems were evaluated by Thorne (1989). Liveweight gains

were substantially improved by supplementing local feeds with concentrate feeds (see Table 2.2). Importantly, the study showed that feed allowances could be restricted, in line with standard formulas for weight-based allowances, without significant reduction in liveweight production.

A range of alternative, low-density energy feeds was also evaluated. Fresh chopped cocoa pods failed to support high liveweight gains due to low intake and feed conversion efficiency. Freshly chopped sugarcane was a poor substitute for cassava as a high energy feed due to its high fibre content.

The constraint for most producers is to identify a supply of high-quality protein, because fishmeal is not available on most islands (although it can be imported from Honiara and Noro at a price). The use of high-quality legumes, such as *Lablab purpureus* and *Arachis pintoi*, should be examined, because legumes can provide part of this protein requirement. Forages should not contain antinutritional components, such as condensed tannins or saponins, because monogastric animals are highly sensitive to these compounds. The use

Table 2.1 Production data for piglets from native and European sows fed local feeds or imported rations (adapted from de Frederick 1971)

BREED	FEED	WEIGHT PIGLETS WEANED/YEAR (KG)	MEAN PIGLET WEIGHT 8 WKS (KG)	GROWTH RATE FROM 8–16 WKS (KG/PIG/DAY)	GROWTH RATE FROM 16–30 WKS (KG/PIG/DAY)
Native	Typical local	17	3.0	0.05	0.05
	Balanced local	78	7.5	0.09	0.17
	Imported	134	13.7	0.22	0.22
European	Balanced local	79	8.3	0.12	0.17
	Imported	185	14.3	0.36	0.34

Table 2.2 Intake and production data for crossbred pigs fed village feeds alone, or supplemented with locally premixed concentrates (adapted from Thorne, 1989)

FEED TREATMENT	MEAN FEED INTAKE (G/PIG/DAY DM)			GROWTH RATE (G/DAY/PIG)	FEED CONVERSION RATIO ^a
	CASSAVA	COCONUT	CONCENTRATE		
a) Chopped fresh cassava offered ad libitum with allowance of fresh coconut	218	161	0	26	13.85
b) Feed a) plus allowance of concentrate	867	300	265	424	3.38
c) Chopped fresh cassava offered restricted with allowances of fresh coconut and concentrate	581	288	262	409	2.76

DM = dry matter

^a Feed conversion ratio is the number of kilograms feed required to produce one kilogram of liveweight gain

of peanut vines and other forms of moderately high-quality protein should also be encouraged. The proposed ACIAR project evaluating poultry feeds should include a component to evaluate high-protein feeds for pig production.

Previous donor support

There is a long history of donor support for pig production in SI, including various research projects, support for veterinary and quarantine services, breeding and multiplication schemes, and direct assistance to farmers. The donor-supported Livestock Development Authority (LDA) piggery at Tenavatu ran a 25-sow piggery that supplied 300 weaners per year as breeding stock for smallholder farmers throughout the country. Feeds were commercial rations and productivity was high; however, the facility was destroyed during the ethnic tension. Breeding stock of variable quality are now being supplied by Malaitan pig farmers.

Small commercial piggeries have been funded through many donor programs over the years, including a current EU-funded Micro Project scheme. These projects generally involve an open-sided shed over a concrete floor than can be easily cleaned, with crossbred pigs and imported feed. Pigs are a mix of exotic breeds, such as large-white, duroc and landrace, and local pigs (sourced from Malaita). A common formulation of feed is 15% fishmeal, 45% copra meal, 40% mill run and micronutrients. The heavy reliance on feeds purchased out of Honiara is a major constraint to profitability.

2.3.2 POULTRY

Domesticated jungle fowl have been a component of village subsistence production in the islands of the western Pacific for at least hundreds of years, because their presence was reported by early European explorers. Recent introductions probably began with the Spanish explorer, Mendana, who is reported to have left exotic poultry in the Santa Cruz Islands in the 1600s. Missionaries and other early European settlers most likely made subsequent introductions in the 1800s. Over the past 30 years, DAL has regularly imported dual-purpose poultry breeds, such as black australorps, Rhode Island

reds, new hampshire and anaconas. DAL's Livestock Breeding and Multiplication Unit at Tenavatu developed parent flocks of these breeds, and widely disseminated them from the 1980s until the ethnic tension. Evidence of these breeds is common in villages throughout SI today. Occasionally, hybrid broilers and layers are also retained and integrated into the village breeding stock.

Production systems

The following three poultry production systems are used in SI:

- > village free-range scavenging system
- > semi-intensive, semicommercial system
- > intensive commercial system.

Village free-range scavenging system

Village poultry systems are minimum input systems where chickens scavenge for feed, but are occasionally fed to prevent them from becoming feral. Feeds consist of cut coconuts, papaws, other fruits and food scraps. Housing is rarely provided. Eggs are rarely found or collected, except by the local dogs. Eggs that are located are generally placed under a brooding hen, rather than being eaten, to ensure future populations. Hens hatch eggs in bush areas surrounding the villages and mortality of chicks is generally high, because of exposure, diseases, and predation by dogs and hawks. Chickens are sold or killed for local consumption.

Semi-intensive, semicommercial systems

Semicommercial systems are generally dual-purpose systems that have been promoted to improve subsistence production of eggs and meat. They involve simple housing to provide roosts and protection from dogs and weather. Ideally, chickens are fed each morning using locally grown or purchased foods, and are allowed to scavenge for several hours each afternoon. In reality, feeding and husbandry may be haphazard. Roosters and old hens are culled for sale or consumption as required.

Intensive commercial system

Commercial production systems for broilers and layers were introduced in the early 1800s.

They are intensive, shed systems using imported hybrid birds and premixed rations. Commercial production systems occur almost exclusively in peri-urban Honiara and supply the larger hotels and supermarkets.

In recent (pre-ethnic tension) times, commercial systems have relied on imported hybrid stock (day-old chicks or fertile eggs) and expensive concentrate feeds. Vuvula Poultry Ltd, currently the only operating hatchery, reports sales of about 150 000 broiler chicks/year, reduced from 300 000 chicks/year before the ethnic tension. The majority of these would be sold to small to medium-scale Guadalcanal farmers at \$8/bird. A significant number of medium-scale broiler farms exist, producing about 1000 birds/batch.

Many broiler operations closed down before the ethnic tension due to nonviable feed costs. Those that remained operational were destroyed during the ethnic tension. Despite this, medium-scale broiler farms are being established around Guadalcanal again for sales into the large Honiara market, although supply is well short of the 1235 tonnes/year produced leading up to the tension. A large volume of chicken meat in the form of whole birds and selected cuts, (approximately 16 tonnes/month), is now imported into Honiara each month from Australia and New Zealand. Frozen whole chickens retail for \$45–55 each. At present, the subsector has a highly varied capacity to succeed, as newcomers grapple with the high costs of imported feeds (currently \$138/40 kg), occasional outbreaks of disease, and the difficulties of timely marketing. Broilers should be sold at six to seven weeks of age, and late sales quickly reduce economic returns.

In the past, table eggs were produced by several commercial layer farms in peri-urban Honiara, but these farms were destroyed during the ethnic tension. There is currently only one large-scale commercial layer farm. The EU has supported seven layer projects of 300–500 birds each. Day-old layers can be purchased from the Vuvula hatchery for \$17/bird; however, there are no parent flocks in SI and eggs are imported from New Zealand and Australia. The viability of these projects is again limited by the high cost of feeds and difficulties in the timely marketing of medium numbers of eggs.

There is considerable interest among local farmers in the potential for egg production using local hens, imported dual-purpose, or crossbred birds, fed with locally available feeds, or a combination of local and imported feeds. Importation of table eggs is continuing to meet the shortfall in supply and there is considerable potential for demand to be met by small to medium-sized layer units. These will become more economical if high-quality stockfeeds are once again produced locally at reasonable prices.

Animal health

At the time of the 1999 animal health survey, SI was free from major diseases of poultry, such as Newcastle disease and avian influenza (Martin and Epstein 1999). Caecal and intestinal coccidiosis and several parasites are endemic, however, along with a number of other diseases. Occasionally, serious losses of broiler flocks are caused by coccidiosis and fowl pox. These are generally environment-related diseases and can be controlled with appropriate management and feeding. Hybrid chicks imported into villages will be exposed to a range of endemic diseases (infectious bronchitis, infectious laryngotracheitis, avian encephalomyelitis and Marek's disease), and should be vaccinated accordingly (Martin and Epstein 1999).

In-country research

The Department of Agriculture and Livestock Industries has researched poultry production over the past 25 years. While early efforts concentrated on medium-scale commercial poultry, the focus changed in the mid-1980s to focus on smaller operations. Chemical evaluation of a wide-range of local and imported feeds was undertaken, in association with broiler production trials. Results focused on growth rates, feed conversion ratios and return on financial investment. Results showed that hybrid broilers cannot be economically raised on local feeds of low nutrient density. Viability of hybrid broiler systems required well-formulated, high-density feeds that support economical feed conversion ratios, produce daily gains of 30–40 g/bird/day and reach slaughter weight in fewer than seven weeks.

Table 2.3 Production data for broilers fed a range of local and imported feeds (adapted from Thorne 1989)

FEED TREATMENT	GROWTH RATE (G/DAY/BIRD)	DAYS TO SLAUGHTER ^a	FEED CONVERSION RATIO ^b	COST/KG GAIN (\$) ^c	RETURN/100 BROILERS/YEAR (\$)
a) Imported single stage	39.7	41	2.46	\$2.71	\$1370
b) Broiler grower and finisher feeds based on local feeds and byproducts	21.2	77	4.06	\$1.26	\$1680
c) Single staged ^d based on local feeds and byproducts	23.9	74	4.32	\$1.13	\$2000
d) Feed b) supplemented with cracked rice grain	29.2	55	2.65	\$0.91	\$2810
e) Feed c) supplemented with cracked rice grain	30.5	53	2.94	\$1.09	\$2680

^a Slaughter weight was assumed to be a liveweight of 1600 g

^b Feed conversion ratio is the number of kilograms feed required to produce one kilogram of liveweight gain

^c Solomon Island \$ as of 1989

^d 'Single stage' feed refers to the same ration being supplied through the broiler's life. The alternative is to provide a 'chick starter' feed, followed by 'grower' and 'finisher' feeds

Table 2.4 Production data for broilers fed combinations of village and locally premixed feeds (adapted from Thorne 1989)

FEED TREATMENT	GROWTH RATE (G/DAY/BIRD)	DAYS TO SLAUGHTER ^a	FEED CONVERSION RATIO ^b
a) Village feeds — coconut, fruits, cassava, green leaves	1.5	1067 ^c	16.48
b) Feed a) plus protein concentrate	2.3	696 ^c	15.17
c) Chick starter followed by Feed b)	15.9	101	2.65
d) Chick starter followed by broiler single stage	24.9	64	2.10

^a Slaughter weight was assumed to be a liveweight of 1600 g

^b Feed conversion ratio is the number of kilograms feed required to produce one kilogram of liveweight gain

^c Predicted only — failed to reach slaughter weight

In the 1980s, the LDA established a feed mill to use locally available byproducts and low-cost feeds. These included copra meal, fishmeal, mill run (wheat) and rice bran. Amino acids, salt and micronutrients were added to the feeds. Reasonable results were achieved using locally mixed feeds, providing they were supplemented with high-quality grain (see Table 2.3). For commercial systems, the economics of using local feeds was reduced by the low annual turnover, despite good gains per dollar spent on feeds. In semicommercial systems, annual gains are far less important than up-front feed costs, and the locally mixed feeds presented a significant opportunity for this subsector.

Improved village systems were evaluated in response to growing interest in village farmers' potential for national livestock production. Table 2.4 presents the results of an experiment evaluating

broiler production using village feeds alone, and in combination with purchased feeds. Hybrid broiler chickens grew poorly when fed local feeds, and growth only improved after significant additions of premixed feeds.

There is a need to evaluate the productivity of dual-purpose birds in improved subsistence and semicommercial systems using various locally available feed components. The proposed ACIAR project will undertake this research.

Previous donor support

The European Union (EU) has supported broiler units of 100–150 imported hybrid birds and layer units of 300–500 imported hybrid birds. The viability of these production units is primarily limited by the high cost and availability of feed, and the ability to sell broilers and eggs in a timely

manner. Some units ceased operations within 12 months of commencing. Some units were also too large for producers with no previous experience in commercial poultry production.

2.3.3 BEEF CATTLE

Unlike pigs and chickens, there is no history of cattle production among the indigenous people of SI. Cattle were introduced into SI in the late 1800s to keep the grass understorey of coconut plantations under control. Records from 1908 suggest that each beast was capable of replacing two labourers in terms of weed control. With copra being such a valuable commodity, weed control was the primary output from this early agroforestry system, with meat a welcome secondary benefit. In the mid-twentieth century, the colonial government became interested in the potential to establish high-quality pastures for beef cattle production in full sunlight, as was being done elsewhere in the tropics. Pasture evaluation and cattle production research continued beyond independence until the mid-1980s. With independence, the research focus swung to assisting smallholder farmers to establish cattle production systems, and the tethering system was promoted.

Production systems

In SI, three cattle production systems have evolved from early research and development work. These production systems are:

- > pastures under coconuts grazed by free-ranging cattle in fenced paddocks
- > open, improved pastures grazed by free-ranging cattle in fenced paddocks
- > pastures directly grazed by tethered cattle.

These are all pasture-based, grazed systems. Stall-fed intensive systems and concentrate feeds are not used. Cattle do not compete for human food resources, although they may compete for land. The early planters used alienated land for their coconut plantations and these lands became the grazing resource for cattle.

Free-ranging under coconuts

The free-ranging under coconuts production system predominates on the coastal fringes of islands where coconut plantations were established by expatriate planters. Mature coconuts allow sufficient light transmission through the canopy to support understorey pasture production. Cattle generally free-graze, simultaneously reducing grass and weed growth to facilitate nut collection and supporting moderate rates of beef production.

Free-grazing of open, improved pastures

Free-grazing of open, improved pastures is a conventional 'western' system, whereby cattle free-graze improved grass-legume pastures, generally developed by expatriate graziers. This type of production was previously common on Guadalcanal, but is now rarely practiced throughout SI. High-quality fences are required to manage cattle.

Tethered grazing

Tethered grazing involves restricting the ability of cattle to range by tethering them on a short rope. It is practised by smallholder farmers with one to five head of cattle and eliminates the requirement for fencing. Cattle should be given fresh drinking water and should be moved four to six times each day to ensure access to sufficient feed.

Potential of the beef cattle industry

Given an annual off-take of 15–20%, the current herd has potential to supply 750 head, or 60–75 tonnes/year of boneless beef, to the local market each year. This represents approximately one-quarter of Honiara's current demand. Despite the poor recent history, the local beef cattle industry can play an important role in the future of SI's livestock sector for the following reasons:

- > the demand for beef is strong and prices are less volatile than for other agricultural commodities
- > SI has high-quality pastures and concentrate feeds that support high levels of beef production
- > cattle play a dual role of keeping the understorey of coconut plantations free from weedy growth
- > cattle suit the life style of Melanesians, and require minimal daily attention.

Butcheries exist in most provinces and managers report an extremely strong demand for beef. On the remote island of Makira, local butcher Moses Oli slaughters two to four head per month to keep up with demand (see Box 2.12). Off-take commonly exceeds the production capacity, so that there is considerable potential for further smallholder involvement in the subsector. There is also potential for sales of chilled quarters or boneless beef in Honiara, especially for provinces within easy reach of the capital.

Smallholder production

There are undoubtedly opportunities to re-establish the estate beef sector on Guadalcanal and Yandina, given favourable resolution of land and labour disputes; however, this document will concentrate on the smallholder sector.

Approximately 100 smallholder families with small herds of beef cattle are concentrated on Guadalcanal and Malaita, and to a lesser extent throughout all the provinces. Many supply beef for household requirements, while others sell to provincial butcheries, RTCs and church missions.

Tethered cattle

The use of brass nose rings for tethering cattle is now the predominant form of management on smallholder farms. This system ensures that cattle are quiet and can be easily managed. Cattle are commonly tethered underneath coconut plantations and should be moved two or three times a day to ensure an adequate supply of pasture. The major disadvantage of tethering is that cattle need daily attention to ensure they have access to food and water.

Free-ranging cattle in fenced paddocks or pastures

Fences are used to contain larger numbers of cattle, but have several disadvantages for smallholder farmers. Fenced cattle are generally not as quiet as tethered cattle, a stockyard will be required for management purposes, and fences need to be regularly maintained to prevent cattle escaping and damaging neighbouring gardens.

Breeding management

Breeding management for small herds poses a difficult problem, because it is not sensible or practical for all farmers to own a bull. There is no local system of artificial insemination, nor is it sensible to establish one. The use of bulls owned by missions and other medium-scale operations is the most efficient way to address this issue. Owners of cows might pay a small service fee for use of mission bulls. This would encourage forming satellite herds within the vicinity of the mission, and help deliver technical information and other services. Bull exchange among larger herds could be done on a two- or three-yearly basis, and new genetics could be introduced from Guadalcanal or RIPEL every five years. In all cases, bulls need to be rope-trained from a young age and strongly selected for temperament — activities that have previously been done by DAL staff.

Animal health

SI is free from economically important diseases of cattle. The country was declared free from brucellosis and tuberculosis in the mid-1980s, while many other serious diseases have never been present. Martin and Epstein (1999) detail a large number of diseases that were not present at the time of the 1999 animal disease survey. The seroprevalence of leptospirosis is high, but clinical symptoms have not been reported in cattle (and rarely in pigs). While various parasites are present, economically important parasites, such as liver fluke, screw-worm and cattleticks, are not present.

In-country research

A substantial amount of pasture and cattle production research was done by DAL and various donor-assisted programs until the mid-1980s. Pasture species were identified for open and shaded (under coconuts) environments and stocking rates were determined. Table 2.5 shows liveweight gain data for cattle grazing native and improved pastures (of *Brachiaria decumbens* or legumes) at three stocking rates, under mature coconut palms (allowing 62% light transmission). The experiment highlighted the productive nature of the legume-rich native pastures, and the advantages of managing

Table 2.5 Liveweight gain data for steers grazing native and improved pastures at various stocking rates, under mature coconut palms (adapted from Smith and Whiteman 1983)

PASTURE	STOCKING RATE (HEAD/HECTARE)	GAINS/STEER (KG/HEAD/DAY)	GAINS/AREA (KG/HECTARE/YEAR)
Native	1.5	0.41	221
	2.5	0.35	318
	3.5	0.25	330
Improved	1.5	0.35	191
	2.5	0.28	259
	3.5	0.23	290

Table 2.6 Growth of heifers grazing three open (full sun) pasture types over a two-year period (adapted from Watson, 1997)

PASTURE SPECIES	STOCKING RATE (HEAD/HECTARE)	INDIVIDUAL HEIFER GAINS (KG/HEAD/YR)	PRODUCTION PER UNIT AREA (KG/HECTARE/YR)
<i>Brachiaria mutica</i> + legumes	1.8	209	376
	2.7	204	549
	3.6	162	582
	4.5	124	555
<i>Brachiaria decumbens</i> cv. Basilisk + legumes	1.8	176	317
	2.7	150	405
	3.6	116	416
	4.5	108	487
<i>Panicum maximum</i> cv. Hamil + legumes	1.8	133	239
	2.7	122	328
	3.6	79	283
	4.5	84	378

native pastures at moderate stocking rates. The ideal stocking rate was found to be approximately 2.0 head/hectare.

Experiments evaluating open pastures were done on the Guadalcanal Plains and highlighted the potential of para grass (*Brachiaria mutica*) to support high individual liveweight gains at moderate stocking rates (see Table 2.6). In contrast, Guinea grass (*Panicum maximum*) pastures were far less productive, and were over-run with weeds at higher stocking rates.

Previous donor support

Pasture research activities were supported for 15 years and contributed much information to the understanding of soil fertility, pasture productivity and cattle production potential in open and shaded

pastures. The Cattle Development Authority, funded by the Asian Development Bank, commenced in 1977 and helped to provide cattle for domestic needs and, when possible, for export production. The initial project expected cattle numbers to increase to 52 000 head by 1984; however, cattle populations reduced to 20 000 head by 1984. At this time, the program became the Livestock Development Authority (LDA) and changed its focus. The LDA ran multiplication programs to deliver cattle, pigs, poultry and goats to the country's smallholder farmers. It also ran a commercial feed mill. Many of the LDA operations were concluded in the mid 1990s.

The significant outcomes of donor support from this period were eradicating brucellosis and tuberculosis, and supporting the DAL animal health laboratory.

Unfortunately, donors no longer fund animal health and veterinary support.

There has been very little support for beef cattle (or any livestock) development over the past decade, in lieu of the limited impact of significant support over several previous decades. It is timely to assess past failures and learn from successes in SI and elsewhere in the southwest Pacific, notably Vanuatu.

2.3.4 HONEYBEES

The European honeybee (*Apis mellifera*) was introduced to SI by missionaries in the 1800s, although Solomon Islanders have opportunistically exploited native bee hives over millennia. Villagers have been involved in honey production since 1989, when New Zealand's Official Development Assistance (NZODA, now New Zealand's Agency for International Development — NZAID) commenced a series of apiculture development initiatives that continued throughout the 1990s. More recently, honey production has been supported by Canadian volunteers (CUSO) based in Auki, Malaita.

The Solomon Islands Honey Producers Cooperative Association was formed in 1989 to provide training, equipment, a guaranteed market for honey, and processing and marketing of product. The association's infrastructure was badly damaged during the ethnic tension and it is currently in a rebuilding phase.

Production peaked in the late 1990s, when there were about 2000 hives producing approximately 75 tonnes of honey. There is a good international market for organic (pesticide and antibiotic-free honey), and 30 tonnes were exported from SI in 1999. Hive numbers probably halved during the ethnic tension, largely because of the devastating invasion of the Asian bee (*Apis cerana*) into Guadalcanal and parts of Central Province, and the destruction or abandonment of beehives during the ethnic tension. Honeybee production in these regions has now virtually ceased. The Asian bee will probably spread throughout the major islands over time, although the more remote islands may be spared. Strategies are currently being developed to minimise the impact of the Asian bee, and early results are positive.

SI has the potential to produce honey of reasonable quality in moderate quantities. Production and quality are limited by the country's high rainfall, (which reduces flying opportunities and therefore honey yields), and high humidity (which, if greater than 20%, causes a high moisture content in honey, leading to fermentation and spoilage).

Considerable in-country capacity has been developed over the period of assistance. There is an apiculture unit with DAL, and 16 Solomon Islanders have received extensive training at Telford College in New Zealand; however, few of these 16 people are actively involved in beekeeping at present. Between 400 and 500 farmers have received basic, in-country training in the past two years. Much of the hardware required for honey production is produced locally; however, importing beeswax foundation is the major expense for local producers. Start-up costs of \$1000 to \$5000 are required for 1–10 hives, and these costs are a major disincentive to potential honey producers. The EU has supported the establishment of some medium-scale units, each with 100 hives; however, this level of operation was beyond the ability of many producers to handle, and often, inexperienced farmers were involved.

Beekeeping has been introduced to 12 RTCs throughout the country as both an income-earning enterprise and for teaching purposes. A beekeeping curriculum has been written and will be introduced as part of the agricultural program in 2005.

2.4 CONCLUSION

This chapter has described the current state of the SI livestock sector, and suggested interventions for improving the livelihoods of rural families who are dependent on the local pig, poultry, beef and honey industries. The chapter also includes an overview of current production systems for pigs, poultry, beef cattle and honeybees, the health status of these livestock groups, and previous research and donor support. Key references and people consulted are provided below.

Chapter 3 (*Gender, cultural and social issues*) expands on methods for improving production systems in SI by examining gender, social and cultural issues that affect decision making in agriculture programs.

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2.6 PEOPLE CONSULTED

- Akipu, Patterson
Quarantine Inspection Service, Honiara
- Carlos, Sam
Agricultural Extension Officer, DAL, Kirakira, Makira
- Craig, Paul
Project Manager, European Development Fund, Honiara
- E'eniara, Jeffrey
Agricultural Extension Officer, DAL, Kirakira, Makira
- Gapu, Kemuel
Agricultural Extension Officer, DAL, Kirakira, Makira
- Haamori, Benson
Village meeting, Boro'oni, Makira
- Hagasuramo, Gad
Bauro Farmers Support Association, also Provincial member Ward 9 (West Bauro)
- Jansen, Tony
Consultant, Kastom Garden Association, Burn's Creek
- Keqa, Barnabas
Beef Cattle Research Officer, Department of Agriculture and Livestock, Honiara
- Moses and Charlotte
EU-funded small piggery, Kaonsugu, Makira
- Nonga, Nichol
Pigs and Poultry Research Officer. Department of Agriculture and Livestock, Honiara
- Oli, Moses
Manager, Kirakira butchery, Kirakira, Makira
- Pelomo, Moses
General Manager, Commodity Export Marketing Board, Honiara

Pepena, Hyacinth
Livestock Teacher, RTC, Manivovo, Makira

Punia, Alphonsus
Agricultural Extension Officer, DAL, Tawapuna,
Makira

Sanau, Benson
Agricultural Training/Extension Officer, DAL,
Kirakira, Makira

Siwa, Robert
Coconut mill manager, Arosi Vision Link Services,
Tawani, Makira

Styvenberg, Makira
Styvenberg Catholic RTC

Tagini, Eddie
Floor Manager, Sullivan's Butchery, Honiara

Tahi, Benedict
Farmers Support Association, also Provincial
member Ward 11 (East Bauro)

Talanfei, Zakariah Agriculture Teacher,
St Steven's RTC, Pamua, Makira

Tim, Sam
Senior Agricultural Extension Officer, DAL,
Kirakira, Makira

Tong, Ringo
Manager, Layer Farm, Tong's Corporation, Honiara

Tsatsia, Francis
Quarantine Inspection Service, Honiara

Wagatora, Silas
Diocesan Secretary, Diocese of Hanuato'o, CoM,
Waimapura, Makira

Wate, Dudley
Director, DAL, Honiara

Watoto, Paul
Coconut mill manager, Arosi Vision Link Services,
Tawani, Makira

3 Gender, cultural and social issues

SUMMARY

This chapter provides an overview of the issues relating to gender, culture and social structures that influence agriculture and rural livelihoods. It discusses and examines the roles women and men play in food production and cash economies, and the impact cash has on subsistence living and survival. Particular attention is given to the role women play in subsistence agriculture, because they bear the bulk of the work for family and community survival. Issues relating to food production and rural livelihoods affect stakeholders outside rural communities. Therefore, the roles that government and other stakeholders play in decision making, management, policy issues and their linkages to the rural communities as service providers are also important.

The chapter is divided into sections relating to gender (including roles in agricultural activities), cultural issues (including the implications of a cash economy) and social issues (such as health status, productivity, training, support and facilities for agriculture).

Section 3.5 (*Recommendations*) lists recommendations for improving agricultural decision making, and therefore improving rural livelihoods. These recommendations include:

- > improving women's training in agricultural activities

- > increasing women's representation in agricultural activities
- > improving agricultural business and management training for rural communities
- > encouraging and facilitating income-generating activities in rural agriculture.

The reasons for each recommendation are provided in the form of constraints and opportunities relating to gender, cultural and social issues.

3.1 INTRODUCTION

Traditionally, agricultural communities in Solomon Islands (SI) were based on subsistence economies, where produce was consumed by rural families, rather than being sold for profit. More recently, there has been a shift to a cash economy and farmers produce agricultural surplus to sell in rural and community markets.

Despite this transition, rural livelihood in SI is still predominantly agriculture and marine-based. Agriculture production has sustained the local population over centuries, but is now being threatened by high population growth and high rates of indiscriminate resource use. Changes in agriculture production in rural areas revolve around the gender, cultural and social environments. It is therefore important to consider these issues in any strategy to improve agriculture to sustain and improve rural livelihoods.

Women, who are resource custodians and major food producers, are often voiceless and become silent listeners when agriculture development programs are discussed and designed. Women are often denied their wealth of knowledge and expertise in agriculture when it comes to planning and decision-making opportunities in agriculture programs. Men, who dominate the cash crop domain, are considered fortunate to have more access to training and agricultural development incentives. Women are rarely consulted during logging and agriculture development projects on their land. Generally, it is the rural communities, particularly women, who bear the negative impact of any rural development.

Strong family links are the social security system that supports rural households. Food produce from the garden is shared, along with income from both food and cash cropping. Households are obliged to contribute to feasts, marriage or bride prices, school fees, and common village activities. Individual wealth accumulation to improve village quality of life is not a priority.

Social and cultural obligations and responsibilities can have a negative impact on agriculture enterprises or any business undertaking. Consequently, any engagement with the rural communities in SI must take into consideration gender, social and cultural issues, which are important for rural livelihoods.

3.2 GENDER ISSUES

This section examines issues relating to gender, particularly women's roles in food production, and shared-gender roles in cash crop production and food marketing.

3.2.1 FOOD PRODUCTION

Traditionally, women's roles in food production are significant for household livelihood, family survival and cultural obligations. A woman performs her daily gardening roles to provide food for the family. Gardening is therefore an essential activity for rural livelihood; however, women's pride and status in the gardening domain comes with a high workload,

multiple roles, and longer working hours than men. Any program that addresses the agriculture sector should not only boost agricultural production for survival, but also support women's morale and position in society.

Although women do the bulk of work involved in food production, men and youth assist them with certain tasks, such as clearing, tree felling, hoeing and harvesting. Young girls assume greater responsibilities for the gardening processes compared with young boys. In areas of agricultural land with long fallow periods, this pattern of sharing responsibilities is typical; however, in areas experiencing short fallows, women take greater responsibility for the entire garden, thus the overall load of food production shifts more towards women. Throughout SI, women typically own more than one garden for food security, creating a demanding workload. In some areas of the country where more young people are migrating to urban centres, food production is left to older women and men. Men spend a significant time in village governance (attending to meetings and leadership issues surrounding families and community affairs), as well as spend time fishing and constructing houses and woodcrafts, but these roles are spread over a longer period.

Although women are the major food producers in the subsistence economy, they have less access to agricultural training, information, planting materials, extension support services, and proper infrastructure. Lack of assistance for women in their capacity as food producers poses a further threat to their livelihood and that of their families and communities. Population pressure on land and women can cause ill health, overworking and poor nutrition. In addition, inland populations are disadvantaged compared with coastal communities in relation to agriculture training and services. Appropriate programs should be designed to improve food production without exerting pressure on women's time and the other limited resources they have. Particular attention could be given to women in inland communities, because their agriculture and nutritional needs are different from women of coastal communities.

3.2.2 CASH CROP PRODUCTION

Cash cropping complements subsistence food production by providing cash for purchasing essential items, such as processed foods, household items and education. Men typically organise cash crops (copra, cocoa, honey and spices), and sell and handle cash, while women and youth assist with labour. Men dominate and control cash crop activities, and cash is generally associated with status, power and wealth. Men and women who have access to cash also have the purchasing power and choices to spend money where they want.

Women's involvement in the cash crops domain is limited to time-consuming and tedious activities, such as brushing, clearing, weeding, pruning and harvesting. These activities receive minimal payment and increase the load that women already bear from existing social commitments to family, community, school, church and women's group activities. This additional workload of women is reflected in a study done on Malaita and Guadalcanal in 1985–86 (Jones, Fleming, and Hardaker 1988). This study found that men and women together spent 20% to 30% of their waking time on economic activities outside the home, but men alone spent only 5% to 10% of their time on economic activities within the home, compared with 20% on average for women. This result reflects that women's lives are dominated by economic activities, both within and outside the home, compared with men who spend more time on noneconomic activities. Women's access to cash, though limited, is a breakthrough of the gender boundary, because control of money has traditionally been considered a man's domain. This development allows women to participate with men in cash cropping, marketing and owning a business enterprise. The case study below demonstrates the significance of women's access to cash.

Although cash cropping is essential as it gives access to cash for rural communities and increases economic growth, it can have a negative impact on women's roles in terms of pressure on land, pressure on their subsistence agriculture roles and pressure on family responsibilities. Cash cropping that is cost-effective and fits in well with traditional farming systems, such as kava, coconut,

CASE STUDY: WOMEN'S ACCESS TO CASH

Ms Mary (not her real name) is a kava farmer at Kolomola. She grows a kava farm close to her house, and she harvests, dries and packs kava for sale. Usually, she would give the packed kava for her husband to sell on her behalf; however, one day she decided to sell her kava herself. She packed her kava and went directly to the salesman for the first time. She received \$200 for her kava, and was so excited and happy with her achievement that she decided to put off any gardening or housework and instead rested for the whole day. Ms Mary now regularly sells her kava and manages her own money.

honey, cocoa and indigenous tree crops, could be considered as suitable cash crops.

3.2.3 FOOD MARKETING

Garden surplus is sold for cash, and food and vegetable gardens are more commonly being grown exclusively for marketing. Basic marketing facilities are noticeable everywhere in the rural communities. Women comprise the majority of the market vendors compared with men at the majority of market outlets, selling mostly food crops. Although men dominate the sale of fish, their role in marketing subsistence crops is limited to assisting women. Vegetables, fruits and root crops (such as sweet potato, cassava and taro) are the most common crops sold in the markets by women. Sale of betel nut is also becoming common among women and men, and nuts, coconuts and marine resources are also common. Marketing is seen as a gender-shared activity.

Sale at the rural markets provides women's access to and control over cash. Rural men are more involved in markets located at a distance, such as in provincial centres and Honiara. Most rural women choose to remain at home and sell at nearby rural markets, because of transport difficulties, transport costs and travelling distances. In some instances, women take up the challenge to bring their markets to Honiara and take control over cash earned. Although earnings by men and women are usually kept separate, a significant number of men trust their wives to manage family finances. While marketing is an incentive to cash earning,

women and men experience hardships, such as sleepless nights, loss of time, transport expenses by boat or trucks, paddling a canoe or walking for longer distances to access a market. Lack of proper infrastructure, transportation and communication makes marketing a risky, dangerous and demanding job. Earning cash requires hard work.

3.3 CULTURAL ISSUES

This component examines the issues relating to a transition from a traditional subsistence economy to a cash economy, including cultural problems caused by the change.

3.3.1 TRANSITION TO A CASH ECONOMY

The practice of sharing and caring as an important concept of communalism contributes significantly to rural livelihoods. In rural communities and families where cash is inaccessible, sharing resources and caring for each other provides the support network that families need to survive. Even with introduction of a cash economy in rural areas, households' or peoples' attitudes towards cash income revolves around the subsistence economy. People share and spend cash income similarly to the traditional way in which they share produce from their food gardens and harvest from their marine resources. On most occasions, they spend their cash on consumables (including rice, noodles, alcohol, tobacco, or gambling), rather than investing it to improve village life (such as building permanent houses, or improving living standards and water and sanitation). Although owning a permanent house would be preferred to a leaf house, savings from market produce and cash crops would take years to accumulate before a permanent house could be completed. Building permanent houses is expensive and requires additional assistance from relatives who are employed with regular salaries. Generally, people do not plan or budget how to spend their rural income.

3.3.2 CULTURAL PROBLEMS CAUSED BY A CASH ECONOMY

In some areas of SI, the cash economy has also eroded the social fabric that binds the community together. While cash is essential for rural livelihoods, the cash economy has damaged the communal spirit of caring and sharing with each other. Sharing resources is an integral part of SI culture. Any individual, family or leader who does not embrace or adhere to this cultural value is heavily criticised and considered to be unkind, selfish, and individualistic. The practice of sharing should not be underestimated and ignored, even within cash economies and business development. Therefore, it is important that further introduction of the cash economy in rural areas must be done cautiously, because it can destroy the communal spirit.

3.4 SOCIAL ISSUES

Marketing, cash cropping, business enterprises and logging have created opportunities for the rural population to access cash, and have some positive implications for rural livelihoods and the cash economy. Access to cash means further engagement in cash activities in the future. Access to cash also allows rural families to finance their basic needs rather than exerting financial pressure on their other family relatives; contributes directly towards financing other social obligations, such as community fundraising, women's group and church activities; provides food security and crop diversification for both the short and long-term; and gives women purchasing power and informed choice on certain goods and services.

However, the introduction of the cash economy into the rural setting, through cash cropping, business enterprises and marketing garden produce, has caused some social problems in rural communities. These problems include poor health caused by changes to the traditional diet; social problems caused by alcohol and drug use; decreased productivity caused by population pressure on agricultural land; discrepancies between time investments in smallholder cash crops and productivity; lack of training and support for agricultural activities; and inadequate banking,

credit and market facilities in rural areas. The following sections provide details on these social issues arising from a cash economy.

3.4.1 HEALTH PROBLEMS

The increased consumption of imported processed food (including rice, noodles, tinned fish and meat, sugar, tea and flour-based items), has increased noncommunicable diseases, such as diabetes, heart disease and infant malnutrition. About 60% of rural household income is spent on processed or imported food from shops, which is slowly replacing fresh, staple crops (such as sweet potato, cassava, taro, vegetables and fruits). Processed foods are regarded as a convenient and high-status food, while fresh garden foods are associated with low status and local mindset. Conversely, processed foods are also considered essential for food security on a short and long-term basis. Nutrition education and training should form an important component of agriculture training.

Alcohol and drug consumption is evident where cash is available and accessible. Home-brewed alcohol ('kwaso') and marijuana are readily available in many rural communities, and cause social problems that disrupt the communal social cohesiveness and victimise younger generations. This situation also exacerbates an unproductive youth population, putting greater pressure on women to support their survival. Using the youthful population in rural economic activities and providing training is therefore important.

3.4.2 DECREASED PRODUCTIVITY

Population pressure on the land has led to short fallows, stress on land, overcrowding and poor crop yields. These pressures subsequently increase women's workload.

Most rural households are typically subsistence producers and not full-time cash crop or livestock farmers. They have many other commitments, including family, social and community obligations. In the past, huge investment in smallholder cash crop production has not resulted in corresponding substantial increases in production. Livestock

(particularly cattle) and other cash crops failed because of the lack of time commitment to ensure a sustained and successful enterprise. Any agriculture intervention must build on the existing farming systems.

3.4.3 INADEQUATE TRAINING AND SUPPORT

Many people in rural communities have limited knowledge and skills in basic business management and bookkeeping. These skills are necessary to enhance and sustain agriculture enterprises operating within strong social and cultural environments in the village. Many rural businesses have also failed because of mismanagement.

The 'middle-man' milieu has provided an alternative for marketing domestic products. The middle-man has the time and the resources to purchase produce from the rural farmers at their own costs. This arrangement is cheaper and protects the rural farmers from spending their money on unnecessary costs in Honiara, and provides an alternative market outlet. Most people, however, feel that middle-men exploit farmers and make big profits from their produce — an assumption that may need further research.

3.4.4 INADEQUATE FACILITIES

Marketing facilities in many rural areas and provincial centres (for example, in Auki) are in poor condition, overcrowded, and unhygienic. They need renovation and improvement. Market vendors are exposed to the elements when they sell their produce. Transport and communication infrastructure are critical factors that determine market opportunities, and where transport is difficult, women are denied marketing opportunities.

In the rural areas where banking and credit facilities are absent, rural women and men have no choice but to save their cash in a box, basket, among clothes or between the pages of a book. This makes saving difficult and instead, cash is used for essential items, such as kerosene, soap, tinned fish and meat, sugar, tea, transport, children's education and social obligations. Cash is earned to meet needs

rather than planned and budgeted for the future. If banking facilities were accessible in the rural areas, perhaps only a minimal number of people would save their earnings.

3.5 RECOMMENDATIONS

This section identifies recommendations for improving agricultural decision making by taking into account the issues relating to gender, culture and social structure, and the opportunities and constraints associated with each.

3.5.1 IMPROVING WOMEN'S TRAINING IN AGRICULTURAL ACTIVITIES

Recommendations

- > The women's network needs to expand its training program to non-welfare areas, such as agriculture, business training, local knowledge and skills. To achieve this, the network needs financial support.
- > The Department of Agriculture and Livestock (DAL) needs to devise and tailor their agriculture-training program towards women's needs within the subsistence and cash economies, paying particular attention to the highland and coastal populations. Women require a special training component for all the provinces within DAL.
- > The use of insecticides should be discouraged while organic farming should be encouraged for all women's groups through agriculture training.

Constraints and opportunities

Although women have a major role in the livelihood of the rural population, they receive less agricultural training than men. Furthermore, there is less donor assistance and agriculture training tailored towards the agricultural and business needs of rural men and women, compared with people in urban areas.

Women in particular need agriculture support and backup, which can be provided through community groups and networks. There are approximately 3000 community women's groups, approximately 10 national women's organisations and 10 indigenous women's associations operating in SI. Despite

their benefits, however, women's networks are unrecognised, underused and under-resourced. The women's network program has centred on women's traditional role and welfare areas, but does not provide training in agriculture or business management. Financial assistance for this network will address women's needs for agriculture and business training.

Most of the women's groups belong to the churches and are guided by their church leadership and policies. This church women's network exists at the national level, reaching the rural communities, and is founded on commitment, self-financing and volunteering. This provides a cost-effective network and mechanism for reaching rural women and for providing training. A similarly effective network and support service does not exist for men.

3.5.2 INCREASING WOMEN'S REPRESENTATION IN AGRICULTURAL ACTIVITIES

Recommendations

- > Women are essential contributors to the rural livelihoods of the family and the community and therefore should be represented at the decision-making level, especially on issues relating to land development projects, environmental projects and logging operations.
- > Agricultural regional bodies and the DAL (including the provincial agricultural departments) must take into account gender equity in their recruitment exercises to cater for women's needs for agriculture training, information and advisory roles.
- > A women's centre as a market outlet for women's garden produce and crafts should be constructed at the provincial centres.

Constraints and opportunities

Women's active engagement in subsistence economy is not reflected in the DAL human resources development. DAL is dominated by male staff at all levels (from national to provincial extension services), and while a significant number of women were trained as agriculturalists, the

government's recruitment policy failed to use them to provide agriculture training for other women.

In addition, women's exclusion from the decision-making level (particularly on land matters, such as logging and development projects) does not allow them to have an input in important matters and agricultural development affecting their lives. Women's low literacy rate also contributes to the lack of understanding of issues affecting their lives. The increased workload of women as active participants of both the subsistence and cash economies is weakening their health, causing physical burnout and denying them of their need to 'take time out'. On the other hand, men's workload has decreased.

However, rural women are participating in the subsistence and cash economies, implying that they have existing knowledge, experience and skills of gardening processes, either for survival or for cash. This knowledge is passed on from older generations to the younger generation by word-of-mouth and practical demonstration. Women are committed to the livelihood of their families and communities and they are capable farmers.

3.5.3 IMPROVING AGRICULTURAL BUSINESS AND MANAGEMENT TRAINING FOR RURAL COMMUNITIES

Recommendations

- > Basic bookkeeping and business-management training should be provided for rural women and men. This should take into account communal values and allow profits to be made.
- > Business and management training needs to be provided to help business entrepreneurs manage social pressures.

Constraints and opportunities

In a cultural environment of communal living and sharing, giving rather than receiving, and cooperation rather than competing, allows limited room for successful cash cropping and business entrepreneurship. Many men and women managing income-generating activities find it difficult to say no to pressure from family members and friends to

borrow cash for funerals, weddings, feasting and social obligations.

Past national initiatives (such as rural credit unions and cooperatives) have failed to alleviate problems caused by the transition to a cash economy. Village credit or 'kaoni' is a significant cultural, social and economic problem in the village. Agricultural enterprises and village retail shops are struggling to remain viable by discouraging buying on credit, and are criticised for being selfish and individualistic. Credit is a disincentive to any investment or enterprise development. Coping with social pressure while ensuring business survival is difficult; however, managing social pressures can be achieved through training.

3.5.4 ENCOURAGING AND FACILITATING INCOME-GENERATING ACTIVITIES IN RURAL AGRICULTURE

Recommendations

- > Root crop and fruit processing should be encouraged as a form of food security and income-generating activity.
- > Some marketing facilities in the rural areas need to be upgraded to cater for the high demand for cash through the sale of garden produce, fish and marine resources. The use of provincial and community market buildings needs to be encouraged.
- > Marketing opportunities for cash crops need to be explored and resourced. Women market sellers need training in marketing skills, confidence-building and time management. The middleman milieu as an alternative market outlet needs to be encouraged and promoted.
- > Coordination and networking all stakeholders of subsistence and cash economic activities should be established at all levels, including the DAL, national government organisations, Kastom Gaden Association (KGA), rural training centres (RTCs), women's groups and rural farmers. RTCs could be connected to rural farmers.
- > The youth population should be encouraged and involved in food production, agriculture training and income-generating activities.

Constraints and opportunities

Proper infrastructure, such as transportation and communication, are lacking in the rural areas and between islands. In addition, women have drawn attention to the fact that suitable land in close vicinity for subsistence gardening has been used for cash cropping (such as coconut and cocoa), resulting in men enjoying a comfortable, shorter walk to the plantations to carry out their cash crop activities while women have to walk for long distances and hours to tend to their gardens.

Rural women's and men's access to banking and credit facilities to encourage saving rather than lending is essentially nonexistent in the rural areas. This threatens any savings initiatives that might be piloted in the rural areas, and challenges the cultural values of giving and sharing.

Further constraints are caused by the lack of coordination and networking among rural community development stakeholders, such as the government, national government organisations, churches, women's organisations and the rural people themselves. Rural women's groups are not well connected to national women's organisations. The top-down approach has dominated past failed initiatives, and past mechanisms need to be evaluated.

In addition, there are not enough organisations, apart from DAL and KGA, promoting agricultural training. Even some RTC do not have sufficient agriculture teachers. In some RTCs, agriculture is perceived as a girls' subject while boys prefer mechanical and carpentry subjects.

Rural men and women have knowledge, experience and skills relating to the subsistence and cash economies, and managing agriculture in both types of economies is a gender-shared responsibility. In addition, the rural youth population comprises around 40% of the total population and plays a significant role, both in the subsistence and cash economy, and could help to increase productivity of agricultural and economic activities, and reduce work pressures on women.

3.6 CONCLUSION

Rural women and men provide the resource base for the livelihoods of families and rural communities. Men dominate the cash crop domain while women dominate the subsistence economy domain. Women's involvement in both the cash and subsistence economy poses problems, such as increased workload, longer working hours and walking for further distances in some parts of SI. Women bear the bulk of the work of rural livelihood, while men's load remains stable or reduced.

Operating a successful income-generating project in a rural setting is limited by the cultural communal values of sharing and giving of resources among families, clans and communal neighbours. Often, social obligations take precedence over cash enterprises. Sharing and giving are not only seen as challenges to the cash economy, but are also seen as social security and investment for the future.

While the introduction of the cash economy into the rural setting has allowed greater access to cash for rural women and men and is a significant improvement on the cash-earning power of the rural population, the effects of cash must not undermine the social and cultural structure of rural communities.

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3.8 KEY PEOPLE CONSULTED

Group meetings (Isabel Province)

Jejevo Women's Week

Kilokaka community

Susubona rural training centre

Kolutubi women's group

Individuals consulted (Isabel Province)

Devi B

Coordinator, CPRF, Isabel

Phylistas L

Coordinator, CPRF, Isabel

Tewani J

Field officer, Agriculture Extension, Buala

Bola L

Kolomola village — kava farmer

Kale G

Kolomola, kava processing

Mazini D

UNDP, Isabel

Hokoto J

WAESP, Isabel

Appendix 2.1 Major food crops

STARCHY STAPLES

SWEET POTATO

Sweet potato (*Ipomoea batatas*) is the most important staple food grown by almost all families across Solomon Islands (SI) and is consumed almost daily by much of the population for most of the year.

Sweet potato was widely adopted after World War II and provided a replacement for taro, which was devastated by taro leaf blight and later taro beetle.

Sweet potato is a productive and resilient crop, growing in a wide range of soils and conditions. It is planted in mounds, which are formed with a hoe.

The number of cuttings and method of planting varies considerably. Diversity at the cultivar level is very high. It also appears that there is a very high turnover of cultivars, with farmers (women in particular) actively sharing and collecting new varieties and discarding old ones. This high turnover may be related to yield decline due to buildup over time of viruses (G Jackson, Plant Pathologist and founder of NGO Pacific PestNet, pers comm, 2004).

There is some anecdotal evidence of this from farmers, although the picture is probably a mixed one, with some cultivars more stable or resistant and hence more consistent over time, and others more vulnerable to viruses. The source of the generation of new cultivars is unknown but is probably related to as yet undocumented farmer selection of natural crosses occurring in fields.

Fast and high-yielding three to four-month varieties of sweet potato are very popular but are usually complemented with some slower-maturing and longer lasting varieties (eg with a longer harvesting period), or with better-tasting cultivars for particular environments and tastes. Marketing sweet potato is common across the country and it is usually sold in heaps of five to six tubers. Prices are extremely variable depending on the capacity to pay. In the Honiara market, the price of sweet potato tends to

be roughly in line with a comparable amount of rice: one heap to a one-kilogram packet of rice. As a rough indicator, it appears that when rice prices go up, so too do sweet potato prices, or the quantity of tubers in a \$2 heap reduces.

Sweet potato is generally planted sequentially in segmented garden blocks marked with sticks or with a heaped organic matter boundary. A pattern of regular planting leads to regular harvest. This activity generally occurs throughout the year. Periodic shortages of sweet potato are usually the result of disruptions to the planting cycle at a family or community level, or too much rain reducing yields or pest outbreaks. Sweet potato does not yield well in excessively wet times and so there are often seasonal failures of sweet potato crops leading to food shortages. This is typically around the middle of the year when there is a gap caused by failed crops planted during the wettest time (earlier in the year). In some provinces, yams traditionally covered part of this gap, but farmers across the country report that the weather patterns are becoming more erratic and unpredictable. There also appears to be a seasonal food shortage that tends to follow a few months after the Christmas (December to January) season when garden work is interrupted by social obligations and activities. Sometimes the wet weather coincides with this time, confusing the source of the shortage (eg lack of planting or wet weather). Often, the shortage is a combination of both.

CASSAVA

Cassava (*Manihot esculenta*) has become widely planted in recent decades, particularly in areas with high land pressure, but is also important in most farming systems. Cassava is often grown in near monoculture plots in short fallows close to villages or in all land in high land-pressure areas. Cassava is also used to extend the cropping period after one

or two crops of sweet potato, or in longer fallow areas as the third crop after taro or yam and sweet potato. It is widely grown around Honiara on eroded grassland hillside soils in urban and peri-urban areas, where it performs much better than sweet potato and so has become a common town food.

Cooked on its own, cassava is considered by some as the least desirable among the root crops — for example among many school students and school-leavers who may have consumed it almost daily for much of their schooling. But this pattern of cassava as a second-rate crop appears to be changing, with cassava increasingly seen as equal with sweet potato in terms of eating preferences. People plant cassava in long-fallow (high soil fertility) gardens, rather than planting other root crops. Cassava is commonly processed into pudding with coconut and is an important food for feasts, market sales, fundraising and Sunday or other special family meals. Most families would consume cassava pudding weekly or more and cassava pudding is for sale in almost all rural markets throughout the year.

Cassava stores well in the ground, for longer periods than most other root crops. It performs well in overcropped, eroded, gravelly and sandy soils, and will yield tubers in almost any well-drained conditions. For this reason, most families grow some cassava as security against other crop failures and because of its usefulness and popularity. In areas with high land pressure, cassava is becoming the dominant crop.

Turnover and collection of cassava cultivars is fairly high. There are probably 30–50 cultivars grown across SI, although ex situ collections do not appear to have been made.

TARO

Taro (*Colocasia esculenta*) has been cultivated in SI since antiquity and is embedded in the culture and tradition of most island groups. Its high cultural and spiritual value is still evident, with taro continuing to be a prestige or high-status crop in many areas. This has also translated into high economic value in rural and urban markets and taro usually fetches three to five times the price of sweet potato in markets. Demand is sustained even at high prices, because

of the customary use of taro at feasts and other important events.

Taro cultivar diversity is great and indicates that SI is within the Melanesian centre of origin of domestication, which gives conservation of taro land races more importance from a biological diversity perspective. For example, in 2001 a farmers' network (Solomon Islands Planting Material Network — PMN) collected 843 named cultivars of taro from four provinces (Temotu, Malaita, Guadalcanal and Choiseul). Genetic analysis of a core collection of this group by the Secretariat of the Pacific Community as part of the TaroGen project indicates that there are probably more than 300 distinct morphotypes (genetically distinct cultivars) in SI. Genetic analysis by TaroGen also indicated that SI taro crosses over Papua New Guinea (PNG) and Vanuatu genes and also contains unique genetic material. This indicates that SI is within the centre of origin of taro and that domestication probably occurred concurrently in different parts of Melanesia — possibly from different sources.

In pre-Christian times, and even up to World War II, taro was the main root crop across the country, and taro cultivation — embedded in culture and spiritual beliefs — was the main activity of rural life. Its displacement from that position today to a secondary or even a minor crop for most farmers is quite remarkable. Taro has been affected by various viruses, including taro leaf blight, 'alomae' and 'bobone'. These two viruses are unique taro diseases from SI that originated in Malaita. Alomae and bobone are managed with indigenous knowledge, although this is becoming more and more difficult as land use intensifies (and therefore gardens become more dense), soil fertility declines, and traditional practices that helped to contain the virus are eroded. Taro beetle is also a major problem and is often ranked as the major problem for taro in provinces without the lethal alomae.

Taro requires fertile soil to grow. In many farming systems, this is no longer available because of shortening fallow periods. In addition, specialised knowledge about growing is needed to manage the high risk of disease and pests. This knowledge is still firmly embedded and often confused among various traditional practices that are increasingly

scorned, misinterpreted or forgotten by a new generation of farmers. For farmers who can manage risks and have the right production environment, taro is a lucrative crop with very good marketing opportunities. In isolated areas, particularly around 400–600 metres altitude where long fallows are still possible, taro has become a very important cash crop, and often one of the few available cash crop options for these disadvantaged areas. Thus, although taro has declined in national importance, it should receive effort to help solve the constraints affecting it, because it has the potential to increase the income of marginalised bush communities.

YAM AND PANA

Yam and Pana (*Dioscorea esculenta* and *D. alata*) are crops with high cultivar diversity (more than 300 cultivars were collected nationally by DAL in 2002). Yam in particular is a prestige crop, particularly in the eastern provinces (Guadalcanal, Malaita, Central, Makira, Temotu), with high traditional value. Yam production is seasonal in most of these provinces with the exception of Central Province where it is grown all year —contradicting traditional experiences in the areas where it is seasonal. In Western Province and Choiseul, yams are grown more in mixed gardens and are less seasonal, although there are reports from older farmers that it was grown more seasonally in the past. Yam is susceptible to anthracnose. In areas where the crop is seasonal it must be planted in a limited planting window, usually between July and October with harvest in March to June. Late planting makes the crop susceptible to ‘lightning’ — the farmers’ name for anthracnose, which is associated with thunderstorm-type weather. On Guadalcanal, yam is an important crop and in many areas it is grown in slash and mulch systems. Yams are planted in a cleared understorey and vegetation is felled on top of the yam garden. This system requires no staking and gives high yields.

Yams store well, have high market value, and provide food during the hunger gap when sweet potato gardens are often producing poorly. However, yam is a fairly specialised knowledge crop requiring

fertile soil and has higher risks than sweet potato and cassava.

Pana, on the other hand, is much more adaptable to intensification and grows well in a wider variety of soils. Cultivar diversity is lower but at least 30 cultivars are still grown, with 12 maintained and distributed in the past by the PMN. Pana also copes well with dry weather and performed well in the 1997 drought compared with other root crops.

In recent years, there has been a steady spread of African yams. For example, they have become common in the Gizo market at certain times of the year. These yams are high yielding and grow in a wide range of environments; therefore, their spread is likely to continue. Aerial yams (*Dioscorea bulbifera*) are a minor addition in some farming systems and there are a number of different cultivated varieties.

Yams have all but disappeared or become rare in some farming systems (eg Kolombangara). It is unclear exactly why this has happened and farmers in Kolombangara have asked Kastom Gaden Association (KGA) to help them recover planting materials and replant.

In Temotu, forest yams (presumably *Dioscorea nummularia* and *Pentaphylla* sp.) have been domesticated into distinct cultivars and are widely grown in cultivated agroforests. This system is interesting, because these yams continue to produce for years once established and store better in the ground than garden yams. Their need for shade makes them ideal companions in agroforestry and they could have applications in many other parts of SI. In Choiseul Province, some edible forest yams such as ‘vurumokoso’ are commonly planted at the base of fruit trees by the side of houses in the village and sometimes also planted in gardens. This shows a continuing process of domestication of wild yams (which are still an important food during times of stress) and a food security strategy using yams with long storability in the ground.

KONGKONG TARO

Kongkong taro or 'karuvera' (*Xanthosoma sagittifolium*) is of increasing importance in some areas where *Colocasia* taro is now too difficult to grow. Kongkong is less affected by taro beetle (although it is still susceptible) and is not affected by the same viruses that affect *Colocasia*. In some areas, for example on Makira, kongkong fills whole garden blocks and is an important new food with similar planting density to cassava. It grows well in sandy soils in similar environments to cassava but has an added advantage of growing reasonably well in the shade and so is commonly planted around villages under bananas, fruit or other trees.

Kongkong does not have the cultural value of 'real taro' (*Colocasia*) and so is not a substitute in feasts or for exchange of shell money.

'EDU' OR 'VURUKA'

'Edu' or 'vuruka' (*Alocasia* taro) is a very important crop in coastal Malaita. It is used as part of bride prices and for purchasing shell money ('tafulia'), giving it a similar cultural value and status to garden taro and yam in Malaita. In these coastal farming systems, it is often planted as the dominant crop in mixed gardens on stony soil, mixed with slippery kabis, yams, corn and other crops. Vuruku is also common in other provinces but is of lesser importance, although some families still plant quite large amounts. It is planted around villages, and compost or kitchen waste is heaped on the base to assist good growth. There appear to be only two edible cultivars: green in the east and purple in Western Province and Choiseul.

'KAKAKE'

'Kakake' (*Cyrtosperma* spp.) (Kwara'ae is the language name but is also commonly used elsewhere) is a very important emergency food for times of food shortage. Kakake is also important for cultural purposes in some areas (eg east Malaita) being made into traditional pudding and having important cultural values for feasts and special occasions. It is grown in most parts of SI, and there are at least four cultivars.

Kakake is of critical importance in atolls where it is grown in permanently mulched swamp plots dug into atoll freshwater lenses or on the border of freshwater lakes. On these atolls it is a daily food. In Gilbertese settlements in Choiseul and Western Province, it is also a staple food, although people are slowly changing to other root crops. The Gilbertese grow unique kakake cultivars that they carried with them from Kiribati.

Maintaining a kakake plot in swamp areas is part of traditional food security strategy across SI. In many places, the custom of growing family plots of kakake on the tribe's land is not being well maintained. Consequently, kakake is not as easily available as it was in the past. Hence, there is increased trade of kakake in times of food shortage. In the past this would have come from pure subsistence plots. This has created a market for those who do maintain kakake but there are shortages in times of more severe stress. Regular consumption of kakake in daily meals is generally a sign of food shortage in most areas. The big advantage of kakake is that it can remain in the ground for long periods of time and hence is 'stored' to be dug up in times of need.

BREADFRUIT

Breadfruit (*Artocarpus altilis*) is a seasonal and occasional food used to various degrees in most parts of SI. In the south and southeast (eg Makira, Temotu and Rennel and Bellona), breadfruit is much more important. Breadfruit reaches its peak of diversity in Temotu where there are reported to be more than 200 named cultivars, which have drastically widened the season. In Temotu, breadfruit is available for most of the year and particular cultivars are processed into 'nambo' — dried pieces of breadfruit flesh that can be storied for long periods and eaten as a snack food or reboiled for cooking in a similar manner to rice. Wild breadfruit varieties occur throughout SI and seeds and fruit are eaten occasionally. In Makira a traditional fermented pudding is made from breadfruit for special feasts — again a prestige food. In most provinces, breadfruit appears to have its main fruiting period from December to March but some cultivars fruit continuously (those from

Temotu) or there may be a second season in the middle of the year.

BANANA

Banana (*Musa* cultivars) is very important throughout SI for cooking and sweet bananas. Bananas are typically mixed in gardens, either planted within root crop plots or on plot boundaries depending on the island. They are also widely planted around villages and sometimes in coconut plantations. In Makira, where bananas are an important staple food, banana gardens are grown sometimes on their own in almost monoculture plots. There is very high diversity at the cultivar level across the country. For example, the PMN, with Manivovo Training Centre and a group of active farmers, has collected 150 named lowland cultivars and 30 highland cultivars in Makira. The cultivar diversity represents an enormous variation not only in fruit types but also in required growing conditions, varying from sandy soil to high-altitude cultivars, of both sweet and cooking types. Banana is nonseasonal and grows well even in times of excessive rain. Surprisingly, there are no banana-dominated farming systems despite its potential to provide food in high rainfall periods (even in Makira sweet potato is still the dominant staple). Sales of sweet and cooking bananas in local markets are an important source of income for many families. On the Guadalcanal Plains, the supply of bananas to Honiara markets is fairly lucrative and probably provides a better return to labour than vegetable production.

SAGO

Sago (*Metroxylon* spp.) is used as a food in Western and Choiseul provinces. Today, this is mostly among Seventh Day Adventist communities, where the processing of sago starch appears to have been adopted from PNG, although it may be also be traditional in the Shortland Islands because of its proximity to Bougainville. Cooking of sago fibre, known as a 'karamau', is a traditional practice in Choiseul and some parts of Western Province but it is rarely eaten today, because few young people are aware of how to prepare it. However, processing

and cooking sago starch is more common, and sago is used as a feast food or for sale in fundraising or markets. Sago is reported to have been an emergency and feast food in some other parts of SI, even as far as Malaita, but is not used much today, and would probably only be resorted to in times of extreme stress. Sago fibre is sometimes fed to pigs.

RICE

Production of rice in SI has been attempted in various forms and through various types of aid and commercial support many times over the past few decades. These support programs ranged from large-scale commercial paddy cultures to upland rice in shifting cultivation. Presently, rice is heavily subsidised by Taiwanese (Republic of China) aid and promoted by DAL. Rice growing has occurred in waves in each province as it is promoted. Subsidies include transporting rice to mills established with selected farmers or run by DAL, and providing mills, fertiliser, training and other incentives. Generally, most farmers give up growing rice after a few crops or, at most, after two or three years, because the return to labour is poor compared with sweet potato, and the crop has a higher risk because it is susceptible to pests, and is expensive to manage. In most locations it is not viable to transport rice for milling or sale, or even as an alternative for home consumption, if using outboard motors. Without subsidies, rice would probably persist as a minor interest crop as is evidenced by small-scale plots of upland rice grown in Bougainville to provide occasional variation to a root crop diet. But it seems that even this minor cultivation is declining now that rice is readily available again as an import at reasonable prices in stores in Bougainville.

Rice is a political crop with many associated government policies and statements about replacing rice imports. If the resources invested in promoting and subsidising rice were properly considered and accounted for, support for rice production would probably be abandoned. However, for the time being, it is likely to continue.

SUGARCANE

Sugarcane (*Saccharum officinarum*) is grown mixed in food gardens as a snack food (eg for eating while working in gardens) and also harvested for sale in local markets and for children to eat at the house. It is planted variously within garden plots, along boundaries of block plantings and around the village. There are many cultivars with different eating, growing and pest susceptibility characteristics. It is a nonseasonal crop.

CORN

Corn is a minor, starchy staple that is usually planted in mixed gardens — often on the same mounds as sweet potato. It is popular and has a good market value, often being cooked in coconut and sold in rural markets as a snack food.

PIT PIT

Pit pit (*Saccharum edule*) ('losi' — Malaita; 'zuzuri' — Choiseul) is a common seasonal variation from January to April in most provinces. It is cultivated in bush gardens in small plots or along garden boundaries in most places, with the exception of the Isabel highlands where it is planted on a large scale after the harvest of one crop of sweet potato. Cultivars are limited, with the most diversity observed in Isabel. A perennial 'fruiting' cultivar called PNG pit pit is grown in some areas of Guadalcanal. Typically, pit pit is cooked with coconut milk mixed with other greens and or vegetables, baked in a motu, or just boiled.

LEAFY GREENS

SLIPPERY KABIS

Slippery kabis (*Abelmoschus manihot*) is the major and most important daily green. Given its high nutritional status and common use, it is important for nutrition and health. It is typically grown in mixed food gardens intercropped with sweet potato or other staples, in garden blocks on its own, or interplanted with other vegetables. Slippery

kabis is increasingly affected by pests, including a devastating shoot borer (*Earias vitellae*) and fleahopper beetle (*Nisotra* sp.). The combination of these two pests has seen a significant decline in cultivation across the country. Both pests appear to have outbreaks at different times of year, in both wet and dry seasons. *Nisotra* beetle in particular is a serious problem and has raised prices and demand in many rural and urban markets. In some farming systems in north Malaita, slippery kabis has almost disappeared in recent years because of these increasing pest problems. This is a serious issue in some coastal farming systems where it was a dominant crop, and critical for income and nutrition, less than six years ago.

Where (and increasingly if) slippery kabis grows well, it is a valuable crop for market and household consumption. This has led to some more market-oriented growers to use pesticides and even DDT on slippery kabis, raising serious food safety concerns. Pesticide use in general is increasing for cash croppers and is of concern given the low literacy and lack of safety procedures for farmers and consumers.

Diversity in cultivars is very high — there are probably more than 50 cultivars, with some narrow-leaf cultivars proving a little more resilient to pest attack. In Western Province, an interesting cooking variation is 'masimasi' — slippery kabis baked with layers of ngali nut — which is a good income earner in local markets and to passing ships. There are many variations and methods of cooking.

FERN

Fern ('kasume') (*Diplazium esculentum*) is a very important leafy green particularly at times when slippery kabis is not available. While it is used in times of shortage of other greens, it is still generally considered to be a good food with good eating qualities. The most common fern species (*Diplazium esculentum*) is collected on river banks and swampy areas. There are at least five other edible fern species that are often locally important in different places, but only kasume is widely sold in markets. All species are nutritious and resilient plants. Sometimes kasume fern is introduced

into new areas of suitable swampy or riverside environments and so can be seen as semicultivated. Other species of edible ferns are often actively conserved when clearing new garden sites. Fern is very common in the Honiara market and an important source of food for people from the Guadalcanal Plains, where it grows prolifically. Fern will fill urban and rural markets at times when there are no other greens available or prices for other greens are high. Where fern is readily available, it is a common, almost everyday, food. At many boarding schools and RTCs, fern has become critical for nutrition of students.

WATERCRESS

Watercress (*Nasturtium officinale*) is grown for home consumption and as a minor cash crop in many areas of SI. It is typically planted in small plots on clear, spring-fed streams. On the Guadalcanal Plains, farmers have developed a system for growing watercress intensively in floating bamboo rafts. This is a high production system that has in recent years been knocked back by diamondback moth, leading to increasing use of pesticides and a pesticide resistance problem, as well as serious safety issues relating to the use of pesticides (eg black market pyrethroid-based malaria sprays not intended for food crops). Watercress appears to be growing in importance and fits the requirements of abundant quantity production for household needs.

PUMPKIN TIPS

Pumpkin tips (*Cucurbita moschata*) are a very important leafy green consumed in a similar way to the other staple greens. Most families will grow pumpkin on and off in their bush gardens and the use of leaves is more important and regular than fruit.

SANPEPA KABIS

Sanpepa kabis ('amou' — Malaita) (*Ficus copiosa*) is a very important leafy green, particularly at times of year when other greens are not available.

GNETUM GNEMON (ZUA)

Gnetum gnemon ('zua' — Choiseul) is another important leafy green, particularly in Choiseul and Western Province, where it is consumed regularly and is commonly sold in rural markets. In north Choiseul, zua is actively managed as part of fallows and is chopped back during cultivation. Around Pangoe, this has led to a high concentration of plants in gardens and bush fallows, which provides a very important source of leafy greens almost year round.

EMERGING NEW GREENS

A number of greens have become common in some areas and appear to be spreading. They have in common the ability to produce large quantities of leafy greens that cook well in coconut milk. These include 'bonio', 'amaranth', 'basella' and 'kangkong'. Bonio is worth a special mention, because in Isabel it has become a main daily green grown in hedges by the sides of houses with tips picked regularly. Recently in north Malaita, this plant has started to spread as an alternative to slippery kabis due the effects of flea beetle.

CHOKO TIPS

Choko tips (*Sechium edule*) are sometimes sold in the Honiara market by bush communities on Guadalcanal. Strangely, this is quite a rare crop and could be introduced to other highlands areas. It is common in Bougainville and it is the most important daily green in mountainous areas of Bougainville.

CHINESE CABBAGE

Chinese cabbage (*Brassica* sp.) is a high-status cabbage grown mostly for markets. It is fast growing but a little more difficult to grow, because seeds need to be germinated in a nursery. Market gardeners tend to grow imported hybrid seeds. A few open-pollinated varieties, particularly one sour-tasting variety, have become common in farming systems as a minor crop, given their easy cultivation.

OTHER VEGETABLES

Many other vegetables are minor crops in gardens but important for income generation and increasingly desired to add variety and taste to meals, especially among younger generations. Tomatoes (*Lycopersicon esculentum*), eggplant (*Solanum melongena*), cucumber (*Cucumis sativus*) shallots (*Allium cepa* varieties), snake bean and others are all common, but are still minor additions that make an important contribution to local food. Demand is increasing in rural areas and is already high in urban markets, especially in Honiara. There are many locally adapted open-pollinated varieties, but there is also increasing use of imported hybrids with less resistance to local conditions, leading to increased demand for agrochemicals.

The PMN has more than 150 varieties of mostly naturalised, exotic, open-pollinated vegetables, with many introduced to SI over the past 50 years.

BEANS

Long bean

Long bean (*Phaseolus* sp.) is an important food grown by most families. Long beans are probably second only to slippery kabis as the most common leafy greens in terms of regular consumption. Long beans have quite high diversity (about 15 cultivars are maintained by the PMN). They are easy to grow in a wide range of conditions and are usually grown mixed in food gardens or close to the house in sup sup gardens. They are increasingly affected by leaf-footed bug (*Halticus tibialis*), which has reduced production at certain times of year and is a serious problem in some areas. Typically, beans are cooked green in coconut milk in whole pots and eaten in a similar way to leafy greens.

Winged bean

Winged bean (*Psophocarpus tetragonolobus*) production is not seasonal, and it performs well at wet times of year as well as other times. It is resistant to leaf-footed bug. Winged bean is not as important in SI as in PNG, but is still widely cultivated — particularly in northeast Guadalcanal,

where it is a very common vegetable. Four cultivars are maintained by the PMN.

Peanuts

Peanuts are an important cash crop for local markets and in Honiara and other urban centres. The importance of peanuts appears to be spreading. For example, in east Makira, peanuts have become a dominant secondary crop planted after sweet potato. Some processing into peanut butter (Isabel) and dried peanuts (various locations) occurs. Trade in peanuts has become quite sophisticated and includes various middlemen, bulk sellers and street sellers in a similar manner to betel nut.

Other legumes

Small amounts of various other legumes are grown throughout SI. The PMN has collected mungbeans, velvet bean, lablab bean, pigeon pea, cowpea, and various legume cover crops with potential for increased use in crop rotation, improved fallows and animal feed. Most are currently only of minor importance.

FRUIT

PAWPAW

Pawpaw (*Carica papaya*) rates a special mention because it is also commonly cooked green, putting it in the category of vegetables and fruits in terms of importance. It is cooked when other greens and vegetables are not available. It is a very important fruit due to its ease to grow, availability all year and good market price in urban centres. However, it is increasingly affected by fruit fly, which can become a problem around villages but less so in bush gardens.

PINEAPPLE AND MELON

Pineapple (*Ananas comosus*) and melon (*Citrullus lanatus*) have become important seasonal cash crops sold in local and urban markets. In Malaita and Guadalcanal, certain areas have specialised in these crops and they flood the market in season. Generally, pineapple and melon crops are planted by

specialised growers in monocultures. Melon suffers from pest and fungal attack in such monocultures and farmers have resorted to a cocktail of sprays to combat these problems. In north Malaita and Guadalcanal, there are reports of pesticide poisoning of farmers and village water supplies due to careless use of pesticides. Despite this, these fruits have become lucrative cash crops in the areas of specialisation, and melon farmers are able to earn up to 10 times the average local income. Within the village economy, these fruits are grown easily in smaller numbers mixed in home gardens. Pineapple is sometimes planted as a final crop before abandoning land for fallow, or grown in small monoculture blocks for family consumption and parties. Both fruits are available for the Christmas season and many families grow them with this period in mind.

IMPORTANT SEASONAL FRUITS

‘Inkori’ (*Spondias cyathera*) is important for consumption and sale in local markets. Wild mango (*Mangifera* sp.) bear at same time, or slightly earlier, as introduced mangoes — often for a longer period of time. Importantly, wild mangoes will fruit well in areas without a marked dry season, unlike the introduced mango, which can only grow in a few places such as Guadalcanal Plains, Gizo and other pockets in rain shadows on the northeast corners of islands. Interestingly, wild mango is one of the few crops that are traded from Honiara into other rural areas at Christmas time. There is evidence that the mangoes have crosspollinated in north Malaita, producing a large-fruit hybrid. Malay apple (*Syzygium malaccense*) is important for market and consumption, particularly by children.

IMPORTANT YEAR-ROUND FRUITS

Five corner (*Averhoa carambola*), guava (*Psidium guajava*), soursop (*Annona muricata*) and pommello (*Citrus maxima*) are available year-round in most parts of SI. They are often very important for sale in local markets as a snack food, particularly for children. Lime (*Citrus aurantifolia*) fruits year round and is important for flavouring drinks for

fundraisers and various events, as well as being sold fresh in urban markets, and used as a medicine.

EMERGING FRUITS

Rambutan (*Nephelium lappaceum*) and avocado (*Persea americana*) both have increasing importance. Rambutan as a cash crop is now common in markets during its season. Avocado is slowly spreading in popularity as a food to be consumed with sweet potato and, in this regard, has potential to make an important contribution to nutrition.

OTHER MINOR FRUITS

Minor fruits are seen occasionally and usually eaten and occasionally sold in markets. Some of these fruits can be locally important in specific areas and some examples are given below:

- > jackfruit (*Artocarpus heterophyllus*): not common and only has market value in urban markets
- > custard apple (*Annona squamosa*)
- > kumquat (*Fortunella japonica*)
- > lemon (*Citrus limon*)
- > Malay apple giant (*Syzygium megacarpa*)
- > mandarin (*Citrus reticulata*)
- > orange (*Citrus sinensis*)
- > passionfruit — lowland (*Passiflora edulis* f. *flavicarpa*)
- > rollinia (*Rollinia deliciosa*)
- > tamarind (*Tamarindus indica*)
- > *pometia pinnata* (a cultivar in Temotu has large and economically important fruits).

NUTS

NGALI NUT

Ngali nut (*Canarium indicum*, *Canarium salomonense*) is a very important seasonal food across the country with very high cultural value. It is an ancient crop like taro and is embedded in different cultures across SI. For example, in Choiseul, to have a large ‘quana’ (a ngali nut grove) is a traditional

sign of wealth. Ngali was domesticated in Melanesia, with some unique species and cultivars in SI. It is usually planted in groves with other important nut and fruit trees and is an important land-ownership marker.

The ngali nut cycle of flowering, fruiting and harvesting is the sign of season change in Babatana, Choiseul and probably also in other language areas. Ngali nut is seasonal from September to December for the larger nut and a little earlier for the smaller nut. Many people report that ngali nut is starting to produce outside its normal seasons.

Ngali nuts are baked in motu, eaten fresh, dried or smoked in bamboo and used in various types of cooking, including a highly valued pudding of taro and ngali nut. There is enormous potential to further develop ngali nuts, particularly in making processed nuts available out of season, because demand is very high.

CUTNUT

Cutnut (*Barringtonia edulis*, *B. procera*, *B. novae-hibernicae*) is an important nut that produces in flushes throughout the year with intermittent flowering. Cutnut is eaten fresh or sold fresh in local markets. It is an important snack food at the household level and in rural and urban markets. Diversity in cultivars is quite high with much natural variation among the ‘wild’ or bush cutnuts. It is typically grown in nut groves, around villages and as an understory tree in coconut plantations.

ALITE

Alite (*Terminalia catappa*) is a very common coastal tree and nuts are eaten as a snack food mostly by children. Superior cultivars with much larger fruit from Temotu and PNG are spreading but not yet common in other provinces. In Temotu, this is an important nut crop, with alite dried and exported to Honiara, often mixed with dried breadfruit nambo. Trees fruit sporadically throughout the year.

COCONUT

Coconut (*Cocos nucifera*) is a very important food used daily by most families. It is used in almost all form of traditional cooking, for drinking and for sale as green and dry coconuts in rural and urban markets. Coconuts do not grow well at higher altitudes in bush communities and so often have to be carried up from coastal areas.

GNETUM

Gnetum is important in some provinces (eg Temotu, Choiseul and Western Province) as a cooked nut. There are two forms of *Gnetum* — one is a small shrub and the other is a medium-size tree that produces nuts in season. In Western Province and Choiseul, the nuts are often sold in the Gizo market.

POLYNESIAN CHESTNUT

Polynesian chestnut (*Inocarpus fagifer*) is an important seasonal food in some provinces, particularly Choiseul (known as ‘qiqiti’), where it is often cooked and sold as a snack food in rural markets. There is much natural variation and only Temotu has superior cultivars that have been selected for larger fruits and more consistent yielding. Some work is being done on the domestication of Polynesian chestnut and cutnut by Richard Pauku, with support from Kolombangara Forest Products Ltd and James Cook University in Australia.