Southern Cross University

Sustainable livelihood strategies for conservation of biodiversity in Fiji, including potential crops and value adding opportunities in three FPAM project sites.

Marketing of suitable products and recommendations; across three project sites: Greater Tomaniivi Protected Areas on Viti Levu, Greater Delaikoro Protected Areas on Vanua Levu, Taveuni Forest Reserve/Ravilevu Nature Reserve on Taveuni.

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Background

FAO's project "Forestry and Protected Area Management" (FPAM) assists four countries, Fiji, Niue, Samoa and Vanuatu, with the goal of strengthening biodiversity conservation and the reduction of forest and land degradation. The project's development objective is to enhance the sustainable livelihoods of local communities living in and around protected areas. Global benefits from the project will include: increased representation of important ecosystems in the protected area networks in these countries; enhanced biodiversity conservation in production landscapes (through mainstreaming and marketing of biodiversity goods and services); increased financial sustainability for protected area management; and reductions in the barriers to sustainable forest and land management.

In Fiji, the FPAM project assists with the consolidation of existing and establishment of new protected areas on the following project sites:

Figure 1: Greater Tomaniivi Protected Area on Viti Levu Island, with trees planted in the FPAM buffer zone

Figure 2: Greater Delaikoro Protected Area on Vanua Levu Island, Fiji.

Figure 3: Taveuni coastal estuary /Ravilevu Nature Reserve on Taveuni Island, with Ivi trees providing a stable streambank even after the very recent Cyclone Winston.

The aim of this study is to identify the potential livelihood strategies for communities in the FPAM areas that support biodiversity conservation and enhance restoration of degraded landscapes. The main focus has been on agroforestry systems, sustainable agriculture and marketable Non-Wood Forest Products (NWFP) appropriate for each of the FPAM areas. The recommendations of which agricultural and landscape restoration systems may be most viable are based on participatory discussions with communities, local government agencies and agricultural, environmental and forest products marketing experts. The development of pathways for marketing of the proposed livelihood strategies is also presented for key agricultural and agroforestry species and secondary range of products across each of the FPAM areas.

The scope of this report is not limited to the extraction of NWFP from within the FPAM areas, but is extended to livelihood strategies that can be conducted in the forest margins around the protected areas.

The livelihood strategies described have been selected on the basis that they will provide sustainable economic benefits, whist maintaining or improving the environmental goods and services in proximity to the FPAM areas.

These products include;

- traditional fruit and nuts,
- honey and beekeeping,
- horticultural crops (Coffee, mango and cocoa),
- oil crops,
- ginger,
- turmeric,
- coconuts (Virgin Coconut Oil, copra)
- vegetables
- floriculture
- ecotourism/agroecotourism

In Fiji, like other areas of Melanesia, land is largely under customary tenure, owned by clans (Matanqalis), including most of the protected areas and forests of the project sites. In general, the forest and nature reserves of the project are managed under government leases (entered into with

the landowners) managed by the Department of Forests. In Vanua Levu, there is a small conservation areas that are also under the management of the National Trust of Fiji located close to the FPAM area.

Engagement with local community and clans is a key priority for any program that aims to develop livelihood benefits and conserve ecological and biophysical processes. Another key priority is the engagement of the government departments who are charged with the responsibilities under the lease. To this end, consultation with the communities and the government agencies has been a key focus of our work in Fiji. The activities undertaken and the results presented in this report have reflected these consultations conducted under a series of site visits in 2016 and follow up visits in 2017. As a part of these visits an appraisal of the sites was conducted by highly experienced scientists in the fields of agriculture, forestry, ecological restoration, market development, sustainable tourism and ecotourism and social research.

The objective of the site visits, conducted by the scientists from Southern Cross University (SCU) was to identify successful and sustainable livelihood development strategies in the margins of the protected areas. This will rely principally on establishing an enabling environment for investment and production of goods and services that support both communities and conservation of biodiversity.

Proposed livelihood activities will also need to maintain the various environmental services and safety nets that forests provide for local people. Biodiversity conservation in production landscapes could be enhanced through marketing of integrated agricultural, agroforestry, ecotourism and development of biodiversity goods and services. Their sustainable use could contribute to the improvement of the local communities' livelihoods.

There are a range of opportunities that show significant potential for livelihood benefits for communities in the vicinity of the FPAM areas, including NWFP collection from within the conservation areas. However, capacity building and demonstrations of sustainable forest management, potential agroforestry and agricultural systems will be important for encouraging adoption by communities. The role of NWFPs is further investigated, to address issues of sustainability particularly buffering remnant biodiversity, soil erosion and catchment protection. The report that follows also suggests supported marketing schemes and development mechanisms may need to be promoted to Government, NGO and industry stakeholders to provide long-term protection of vital biodiversity hotspots in Fiji.

The agroforestry and agricultural systems proposed in this report are based on supporting traditional gardening production systems. In the South Pacific, traditional gardening systems and cultural land management systems are 'vehicles for food security, housing, widespread employment, social security, biodiversity protection and ecological stability; they are also a store of natural medicines, as well as a source of social cohesion, inclusion, and cultural reproduction' (Anderson, 2011, p. 86). These traditional systems also include elements of agroforestry and perennial tree cropping. In conducting these site visits, a major focus was on recognising and discussing the wealth of knowledge on sustainable agriculture and land management that is held within the communities that surround these key protected areas. Many of the proposed livelihood strategies draw on the role that important traditional species and traditional gardening systems have in supporting food security and buffering the margins of key habitats.

Acknowledgments

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Abbreviations

ACIAR	Australian Centre for International Agriculture Research
CI	Conservation International
FAO	Food and Agriculture Organisation of the United Nations
FHLB	Fijian Hotel Licensing Board
FPAM	Forestry and Protected Area Management
FRA	Forest Resources Assessment
MoU	Memorandum of Understanding
NGO	Non-Governmental Organisation
NMA	National Marketing Authority
NTFP	Non-Timber Forest Products
NWFP	Non-Wood Forest Products
PES	Payments for Ecosystems Services
SCU	Southern Cross University
STA	Savusavu Tourism Association
WHO	World Health Organisation

Executive Summary

Conservation of biodiversity, improving rural livelihoods and supporting sustainable agriculture are key issues globally, but for many Pacific Island Countries (PICs) key biodiversity reserves are under considerable pressure from clearing and degradation. Rural communities are often put in a situation where clearing of forest margins is undertaken to meet demand for arable land to produce food and generate income. Forest reserves are also degraded by logging, where timber royalties are important in the absence of other sources of income for traditional landowners and communities. Therefore, agroforestry and ecologically based agriculture systems in the forest margins can help to offset reliance on forest degradation and can enhance the buffers around key reserves. Sustainable forest management and ecotourism also need to be maximised to help meet these challenges of generating income whilst maintaining or enhancing biodiversity, conserving soil and water resources.

Relative to forest management for timber production, non-wood forest products (NWFPs) and environmental services received only scant attention by forest departments until recently. Interest in NWFPs grew slowly during the 1980s, in response to calls for using forests sustainably for the benefit of the wider society and particularly the rural population (Wickens, 1991). An underlying assumption is that communities will conserve and protect forest resources if they receive tangible benefits from sustainable forest utilization (FAO RECOFTC, 1995). While this assumption has been tested in some tropical nations, Fiji still needs to test the livelihood benefits of NWFPs, currently local people need to see proven markets for products and unrestricted rights to forest resources. Despite the recognized importance of NWFPs for income generation and food security (Sorrenti, 2017), clear demonstrations will be essential to establish markets and to prove the economic viability in the Fijian context.

This report will look at a broad range of livelihood strategies including agricultural crops and agroforestry systems and forest products which have food security and cash cropping potential to varying degrees including; palms (coconuts and thatch palms), tropical fruits such as mango, citrus and breadfruit, local nuts, cocoa, coffee, tea, vanilla, ginger, turmeric, vegetables and pepper. This report will also look at linkages between agriculture, protected area management and tourism as a mechanism for generating income.

Introduction

Reconciling food production, sustainable forest management and nature conservation is a challenge shared by all, and this challenge has been identified in many key FAO reports over the last 15 years. Across the globe, research and reports stress the need to maximize the contribution of protected areas to food security and poverty alleviation through soundly managed agriculture. Farmers and forest dwellers, including a large proportion of indigenous people, are the main inhabitants and users of protected areas, as well as lands connecting these areas. So engagement with communities and traditional landowners is a key to success.

Fiji's Forest Economy and Economic Policy

The forest sector continues to be an integral part of the economy of Fiji. Export earnings from forest products rank third in 2010, behind the agricultural sectors (FAO 2010). However, the existing forest sector remains underdeveloped, largely due to the challenges regarding efforts to appropriately capitalize the sector and a loss of industrial capacity. Together with Fiji's continuing dependence on primary commodities, especially for major export earnings, a lack of agricultural and forestry investment has constrained Fiji's economic growth. The downturn in the global economy and in particular, growing uncertainty in the outlook for sugar has combined to limit economic growth below its potential in Fiji.

Agricultural development represents a challenge in Fiji as the traditional industries of sugar and copra are faced with great uncertainty. Shifting to emerging agricultural opportunities requires investment and capacity to support growth. Linking agriculture to tourism has also been held up as a major economic opportunity for Fiji. Tourism is a flourishing industry in Fiji, mainly because of its strategic location and beautiful recreational locations on certain parts of the islands. Intensive capital investment has boosted the dominance of the tourism industry as the main foreign exchange earner for the country.

The focus of tourism in large part relies on the integrity of the environmental assets of Fiji, and therefore maintaining water and soil resources. Sustainable agriculture also has a large role to play in terms of reducing imports of food for tourist operators. The interdependence of tourism and agriculture will be discussed in greater detail in various section of this report. The role of sustainable use of land adjoining forest will also be key opportunity for communities to develop innovative livelihood strategies such as beekeeping, livestock and timber plantation resources to feed and house tourists.

Box 1: Non-Wood Forest Products Definition

FAO defines NWFP as being "goods of biological origin other than wood derived from forests, other wooded land and trees outside forests". Different terms like secondary, minor, or Non-timber Forest Products (NTFP) are also being used by governments, institutions and academics (Unasylva, Issue No. 198, 1999). NWFP may be gathered from the wild, or produced in forest plantations, agroforestry schemes and from trees outside forests. Examples of NWFP include products used as food and food additives (edible nuts, mushrooms, fruits, herbs, spices and condiments, aromatic plants, game, honey), fibres (used in construction, furniture, clothing, or utensils), resins, gums, and plant and animal products used for medicinal, cosmetic or cultural purposes.

According to a recent FAO report (2017): *Data collection on non-wood forest products (NWFPs) has not been systematic for several reasons: (1) the use of NWFPs is often confined to the informal sector and is thus very difficult to capture through formal statistics; (2) the wide variety of products and species that could potentially fall into this umbrella category is extremely vast; and (3) convergence on a universal definition of NWFPs has not yet materialized. As a result, to this day, systematic data collection on NWFPs continues to be difficult.*

This report seeks to begin addressing this issue of identifying and reviewing a range of promising NWFPs in the context of three FPAM areas.

Box 2: Terms of Reference

The terms of reference for the report are: Potentially marketable Non-Wood Forest Products (NWFP's) on three FPAM project sites in Fiji are assessed and further development and marketing of suitable products are recommended; three project sites are: Greater Tomaniivi Protected Areas on Viti Levu, Greater Delaikoro Protected Areas on Vanua Levu and Taveuni Forest Reserve/Ravilevu Nature Reserve on Taveuni. Specific outputs will include: ***a.*** *Participatory assessment with local communities on the three project sites.* ***b.*** *Identification of potential products.* ***C.*** *Recommendations for further development including marketing if suitable products have been identified.*

In developing this report it became clear that there are a range of definitions of NWFPs, even within FAO. However, when countries report to the Global Forest Resources Assessment (FRA) the definition below is used, which is a different definition to the one in Box 1:

NWFP- Goods derived from forests that are tangible and physical objects of biological origin other than wood.

This FRA working definition is products collected from trees outside forests, other wooded land and agricultural production systems are excluded, as clarified in the explanatory notes below:

1. *Generally includes non-wood plant and animal products collected from areas defined as forest (see definition of forest).*

2. Specifically includes the following regardless of whether from natural forests or plantations:

- gum arabic, rubber/latex and resin;

- Christmas trees, cork, bamboo, and rattan.

2. *Generally excludes products collected in tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations and agroforestry systems when crops are grown under tree cover.*

4. Specifically excludes the following:

woody raw materials and products, such as chips, charcoal, fuelwood, and wood used for tools, household equipment and carvings;

- grazing in the forest;

fish and shellfish.

The FRA definition of NWFPs is not very appropriate for the context of this report, and so we will follow the FAO definition of 1999, as it addresses the need to maximize the contribution of protected areas to food security and poverty alleviation through soundly managed agriculture. These principles are key to maintaining biodiversity in the FPAM areas. Farmers and forest dwellers are the main inhabitants and users of the protected areas, as well as lands connecting these areas so livelihood strategies that support these communities need to include agricultural and agroforestry systems that generate income from these buffer zones.

Participatory Assessment of the FPAM sites

An interdisciplinary team of scientists from SCU and SPC have visited the FPAM areas and the buffers adjoining the Tomaniivi reserve, Taveuni and Vanua Levu a number of times. The team comprised expertise in agroforestry, agriculture, social research, livelihoods, community development conservation and reforestation. Initially a visit was undertaken with FAO/GEF FPAM Staff 2015 and twice in late 2016. During each visit consultations were undertaken with the community in the buffers of the protected areas and the traditional owners of the Forest Reserves. A series of workshops and discussions were conducted by the SCU team in 2016 with Government stakeholders to assess the existing livelihoods strategies and to determine the potential crops that may provide a good option given the social, economic and environmental context.

Prior to these visits, discussions with key NGOs such as Conservation International (CI), Live and Learn (L&L) and industry stakeholders such as tourism operators and agricultural producer groups were undertaken. A brief summary of these meetings will be presented throughout the report to inform each of the FPAM sites and the relevant crop systems and livelihood impacts of existing and proposed agricultural, agroforestry and tourism activities.

Tomaniivi

The Project team from SCU visited the FPAM areas and the buffers adjoining the Tomaniivi reserve on three occasions in 2016. During the initial consultations discussions were undertaken with the landowners, local community, NGOs and Government stakeholders. The existing livelihoods strategies were largely based on agriculture and some harvesting of timber. The areas have a long history of timber production and income from timber royalties. The Project Team determine the potential crops that may provide a good option given the social, economic and environmental; context.

The sites at the base of the reserve are unique in Fiji, due to the relatively high elevation. With productive agricultural land at 800m above sea level (ASL), there is potential to grow some crops that are in high demand, but require a low temperature to be cultivated at this location. This includes vegetables and crops that are in highly sought after by restaurants and resorts: such as potatoes, broccoli, some valuable citrus and Arabica coffee varieties. Extensive visits to the reforestation areas surrounding the FPAM Areas, planted by Conservation International (CI), were also conducted. There was some scope to include tree crops in the reforestation activities, particularly Tavola *(Terminalia catappa*), mango, Vesi (*Intsia bijuga*) and tamarind.

Tomaniivi presents a wide range of options for high value agricultural production due to altitude and species options as well as the forest fringe protection potential. Opportunities to enhance the environmental values of this site could be linked to tourism and the hiking tracks. The wide range of options available in horticulture, agroforestry and tourism are unique, as well as conservation and carbon sequestration with a wide mix of potential partners.

Delaikoro

The participatory assessment on Vanua Levu was undertaken on both sides of the Delaikoro Protected Area over the period from August 2016 to February 2017. On the Labasa side of the Delaikoro range there are large areas of sugar production that is experiencing severe issues regarding the declines in markets, smallholder profitability, increases in costs of production (fertiliser and labour costs) and a lack of investment in infrastructure.

On the north side of Vanua Levu farmers discussed the issues of limited livelihood options, the seasonally dry monsoonal climate and the impacts of long-term cropping on soils. The soils on the fringes of the sugar lands are often adversely impacted by long periods of cultivation, high aluminium levels and erosion which reduces the options for profitable livelihood strategies. On the areas which have been cultivated for sugar there are some excellent examples of agroforestry and alternative cropping initiatives, including tree crops such as sandalwood (Santalum album/ Santalum yasi) and Vesi (*Intsia Bijuga*) and honey production, but the financial returns are yet to be demonstrated.

The cost and availability of trees is an issue with sandalwood trees on Vanua Levu, costing up to $7 per tree. In consultation with farmers on the Labasa side of the reserve, honey production is limited by the training and capacity building to ensure production is both optimised and the health and sustainability of the hive particularly overharvesting and concerns about pests and disease.

On the Southern margins of the protected areas there are four communities that have been visited by the Project Scientists, Levuka, Nakawaga, Biaugunu Villages and Waislali community. The Project Team also conducted meetings in the Town of Savusavu with community and tourism operators

Figure 4 Project team consulting with local landowners in the buffers of Delaikoro FPAM area

Taveuni

Consultations with landholders, rural trainers and agronomic specialists were carried out in August 2016 on Taveuni at the Tutu Training Centre. The Centre is where farmers from around Fiji are given a range of skill development courses to assist with income generation and livelihood for rural smallholders. The Tutu Rural Training Centre, has a range of cropping and horticultural systems that are designed to improve rural income and to develop skills relating to irrigation, building and marketing farm produce.

Some training and capacity building needs were identified at these initial consultations were skills in propagation of fruit and nut trees (including grafting). Selection of crops and fruits for subsistence, local markets and potentially markets in Suva. The Centre has a particular focus on Taro (Dalo) and Kava (Yaqona). Coconuts has also been an important crop for the farmers of Taveuni.

At a community consultation meeting held at the Tutu Training Centre with local communities issues raised by participants ranged from declines in yields of traditional local crops such as Kava and Taro, opportunities for value adding, the selection of new crops, honey production and the importance of food security in the wake of Cyclone Winston. Tree crops were seen as challenging given the time to harvest and the issues around communal tenure recognising the ownership of trees and fruits from on communal land.

Young women tended to be focussed on the home gardens, vegetable production, business development skills and other forms of income generation such as jewellery, carving and learning skills relating to tourism development. The discussions with the community identified that many women are leaving the villages to work in towns and resorts to generate income, as the farming and rural income generation opportunities are not seen as viable.

In the areas adjoining the forest reserve concerns about the extractive and at times destructive kava/taro systems for sale appear well founded. This system rapidly clears forest and degrades the landscape as remaining trees become more isolated and susceptible to cyclones, decline and fire. Grass incursion is rapid with soil depletion and increased fire risk and a cyclic decline in fertility and sustainability.

Leguminous tree and ground covers and cyclone resistant long term species are needed to manage soil fertility and start a rotation mechanism. While this is possible, the logistics' of operating in Taveuni and the lack of interest in longer term perspectives make this site difficult. Small demonstrations are possible.

The strategic opportunities were discussed with the principal of the Tutu RTC, Dr Lex Thomson, Dr Kevin Glencross and Dr Wayne Hancock.

- Investigating soil amelioration techniques in taro and kava production systems to reduce the need to clear new areas.
- Identification of crops that can be interplanted with crops to reduce erosion and to diversify incomes.
- There is a lack of genetic material available for farmers to diversify their livelihoods. (including improved varieties of fruit and nut crops, such as mango, jackfruit, papaya, pinaples, vegetable seed, breadfruit.
- The income generation from the production of kava is very high, and the demand for kava both locally and across Fiji is very high and so ex-forest sites are highly sought after for production.

Non Wood Forest Products: Research

The contribution of forests to food security, nutrition, community health, energy, employment and in tackling climate change is clearly recognized at international, national, and local levels. These contribution are also enshrined in legislation and international conventions, namely in the Sustainable Development Goals and the Paris Agreement that seek to conserve biodiversity, improve livelihoods and improve resilience of agricultural and biological systems. The socioeconomic benefits of forests, including the role of non-wood forest products (NWFPs) for generating income, food and nutritional security, basic human needs, and improving quality of life were recently documented by FAO in the State of World's Forest 2014 report (SOFO 2014).

The FAO report estimates that NWFPs generated US$88 billion in 2011, that about 76 million tonnes of food from the forest were consumed on average in the same year. Moreover, the report suggests that forest products contribute to the provision of shelter for about 1.3 billion people and to human health through the use of medicinal plants that originated in forests. The World Health Organisation (WHO) (2002) estimates, in addition, that in 2011 around 2.8 billion people in China, India and Africa used traditional medicines, many of which originated in forests (FAO, 2017).

Currently, there is no shortage of research results on NWFPs, however, most studies in the sector have been descriptive, not systematic, and focused on biological issues, which remain key areas for research (FAO 2017). For a long time the social science dimension has been largely under-researched (Nair, 1995) and that lack of social research continues today (Addinsall et al., 2015).

Engagement with the communities in project areas by specialist extension and social researchers is key to ensuring uptake and ongoing livelihood benefits.

In addition, information on how to sustainably manage forests to yield a variety of products has been insufficient for some time (Wickens, 1991). Though fuelwood has received increasing attention, little is known about the contribution of fuelwood to national economies, employment, and income generation, and how and from where fuelwood is coming to the market. A key priority for rural Fijians is the knowledge on use efficiencies and adoption of improved cook stoves. Improved efficiencies in resource use is a key strategy for reducing impacts on the project protected areas.

Employment and Income Generation

Box 3: Underestimate of employment and income generation of the NWFP sector

The significance of employment and income generation in the NWFPs sector is largely underestimated and remains to a large extent obscure even today. This true value of NWFP is further obscured by the situation whereby forestry assessments have tended to overestimate the employment benefits associated with timber harvests for decades, and the values of the ecosystems services is grossly underestimated (Arrow et al 1995). Enders (1997) cites the example of India, which indicates that this view of NWFP has been highly distorted, NWFPs contributed about 50 percent of forest revenue and 70 percent of income through export.

NWFP in a World of Diminishing Resources

Despite the continuing dependence of many rural people and industries on NWFPs, most resources/products are overexploited. Destructive harvesting is rather common and has occurred over long periods (Peters, 1996), thus casting some doubt on the possibility of promoting the use of NWFPs. In response to labour shortages, declining supplies and strong demands from an expanding market, domestication replaces products collected from the natural forest. It is frequently triggered by unmet demands of markets with potential. An example of this is the longstanding development of large scale rattan plantations in Malaysia (Poh, 1994), where the government is still promoting the rattan industry for export.

Domestication and plantation establishment reduce production costs and increase productivity in key resources that have been traditionally harvested from forest reserves. These plantations and intensive production systems succeed where technologies are available, prices remain high and substitutes do not exist. If natural products can be replaced by industrial substitutes, domestication is of no or only short term significance. A prime example of industrial substitution is medicines that are originally found in forests, which are synthesized once markets are established.

NWFPs in the Rural Economy: Who Benefits?

NWFP are often seen as a way of generating livelihoods for the rural poor, but these resources are often very finite, and over-exploitation is often a result. In forestry, the Government often takes a role in ensuring that harvesting activities are regulated, which is often not the case with NWFPs. The role of regulators or certification systems is to ensure on-going supply therefore some external compliance mechanisms are often recommended, but this can add to costs and complexity for rural stakeholders. In many ways, the NWFP suffers the *Tragedy of the Commons*, where the lack of clear responsibility and ownership leads to overexploitation, this brings up the thorny issues of who has the rights to exploit NWFPs from sensitive or protected areas.

> *In principle, exploitation of NTFPs from natural forests can be sustainable. In practice, it is frequently not. A necessary requirement (but not a sufficient one) for sustainable exploitation is a land tenure system which ensures exploitation rights to local extractors. Since we will not see any major changes in forest tenure, NTFPs will remain accessible not only to local people but outsiders too. Price increases will guarantee over-exploitation even in those cases where outsiders' resource access can be restricted.*
>
> (FAO, 2017)

Summary of Uses of NWFPs and to Whom are they Important (FAO 2017)

- *Several million households world-wide depend heavily on NWFP for subsistence and/or income. Some 80 percent of the population of the developing world use NWFP for health and nutritional needs. Women from poor households are generally those who rely more on NWFP for household use and income.*

- *At a local level, NWFP also provide raw materials for large scale industrial processing.*

- *Some NWFP are also important export commodities. At present, at least 150 NWFP are significant in terms of international trade, including honey, gum arabic, rattan, bamboo, cork, nuts, mushrooms, resins, essential oils, and plant and animal parts for pharmaceutical products.*

- *NWFP have also attracted considerable global interest in recent years due to the increasing recognition of their contribution to environmental objectives, including the conservation of biological diversity.*

Linking Agriculture and Ecotourism in the FPAM Areas

Many of the communities' livelihood strategies living within the boundaries of the FPAM areas are based on meeting subsistence needs and combining traditional crops with cash crops, while also participating in specific target work, which can be described as casual income generating activities for the purpose of meeting short term financial goals and expenditures. To ensure communities are meeting livelihood needs that support biodiversity conservation in production landscapes, households will need to diversify their activities to take pressure off the protected areas from the increasing need for productive agricultural land.

While this report has put forward various NWFP commodities that can provide for increased income, there is a need to establish supplementary income generating activities to support agricultural production such as transport, handicrafts, guesthouse and tourism related activities that are of low impact to the protected areas.

Yet the promotion of these activities should be met with a degree of caution and only be encouraged as supplementary to more stable livelihood activities such as agriculture.

Natural synergies exist between agriculture, livelihoods, and tourism across the Pacific. These synergies are based on the opportunity to replace imports of food and beverage, meeting the rising demand for improved local cuisine experiences and desires to improve the sustainability of the tourism industry. In response to this situation FAO has developed the *Pacific agriculture and tourism policy toolkit,* (FAO 2016) that outlines policy measures designed to promote linkages and drive inclusive growth in the Pacific Island Countries (PICs).

It is recommended that the development of responsible eco-cultural and agro-ecotourism be promoted in the three FPAM areas to generate alternative income for the landowners and communities.

Box 3: Agroecological Tourism in the Buffer Areas of Taveuni Forest Reserve

Traditional farming systems can be defined as "sets of interconnected customary practices of producing crops and animals for food, socio-cultural uses and export which conserve resources, protect the environment and are passed down from generation to generation" (Tofinga in USP/IRETA,

2001: see Tool 34). While the traditional farming systems within the study sites have typically consisted of low-input shifting agricultural systems, there is evidence of a shift to high-input permanently cultivated systems particularly for kava and taro cultivation. The pursuit for increased engagement in the cash economy by some communities, and limited land availability caused by population increases and land degradation is seeing a transition from traditional low-input, diversified agroforestry systems to a stronger focus on cash cropping, which appears to be leading to increasing deforestation (FAO, 2008) (an overview of the key Pacific Food Systems, FAO).

This transition from traditional gardening systems to intensive farming for taro and kava is the key driver leading to increased deforestation. While smallholder taro and kava production is driving the economy in Taveuni, the last 15-20 years has seen smallholder farmer's move from subsistence towards semi-commercial farming which is leading to increased deforestation of the Taveuni Forest Reserve due to poor soils from over harvesting in the buffer areas. Promoting a return to productive sustainable traditional agricultural systems in the buffer zones of the Taveuni Forest Reserve could be encouraged through a variety of mechanisms such as the development of agro-ecotours on smallholder farms.

Agroecological tourism has been defined as *'having a primary focus on the interpretation of sustainable traditional agroecosystems which exhibit cultural and heritage significance' (Addinsall et al., 2016).* As Taveuni already has a substantial amount of accommodation and tourism services it is recommended that tourism products are developed based on eco and agroecological principles. Taveuni is gaining momentum in tourist numbers, therefore marketing and product development should focus on differentiating it from high density tourism locations in Fiji. Marketing Taveuni as an eco-destination with appealing geographical features such as waterfalls, nature walks, and endemic flowers in one such measure to promote low impact tourism.

It is vital that community members interested in developing Agroecological tours receive training in tour guiding and interpretation and product development. Greater Tomaniivi protected area also has potential to further develop eco-cultural and agro-eco products as it is located relatively close proximity to high density tourism locations such as the Coral Coast. It is recommended that products be developed with community members in collaboration with already existing businesses operating in the greater Tomaniivi protected area such as Talanoa Treks.

Box 4: Ecotours in the Greater Tomaniivi Protected Area

Talanoa Treks, a small, award winning tour operator working in partnership with remote communities in the Greater Tomaniivi Protected Area provides visitors with multi-day hiking adventures coupled with rich cultural experiences. Talanoa Treks work with several partner communities (Navai and Nabalesere) in the Greater Tomaniivi Area to support them to supplement their income over and above subsistence farming in a sustainable way. The partner communities are central to the products that Talanoa Treks offer as they host, cook for and guide guests. Talanoa Treks also provide support through training, advice and coaching. Increased opportunities for these communities have been identified by establishing formal accommodation entities. Talanoa Treks provides a great example of low impact tourism that collaborates well with local communities and government to provide rich experiences for tourists based on the natural environment. This provides a good model for other FPAM areas in Fiji.

Village Based Accommodation in FPAM Areas

The Fijian government expresses a desire to expand community based, socially responsible tourism and is working to address major constraints particularly surrounding village based accommodation. The current legislation seems to exclude those without capital to build new accommodation, which automatically excludes a large number of rural communities from developing accommodation services. Under the Hotels and Guest Houses ACT a license is required in any place where a visitor stays overnight. Yet the Fijian Hotel Licensing Board (FHLB) has also indicated that no place within a village boundary can apply for a license as provisions within the Public Health Act do not apply to villages. Additionally, the Hotels and Guest Houses Act requires a lease to be held for any property seeking a hotel license. As it is not possible to lease land within a village, this acts as a significant barrier for communities to establish licensed accommodations within their villages. It is advised that relevant government departments continue to address this complex issue as village based accommodation in the FPAM sites provides opportunities for communities to diversify their income while supporting conservation in FPAM sites.

Developing eco-cultural and agro-ecotours in the Delaikoro protected area while possible, is going to need greater outside assistance to deal with a range of challenging issues, particularly accessing the tourist market, compared to the greater Tomaniivi protected area and Taveuni Forest Reserve. Discussions with the Savusavu Tourism Association (STA) members revealed a lack of coordination not

only between members but also with neighbouring communities and smallholders. The greatest opportunities for the communities surrounding the Delaikoro protected area is in the supply of fresh local produce to the Savusavu Tourism industry. Yet unlike Tomaniivi and Taveuni, Savusavu receives only around 3% of the tourism market.

Growing Markets for Local Produce and Destinations

Food and beverage expenditure is second only to accommodation by visitors to PICs, and unfortunately most of this spending is directed to imported food stuffs, resulting in large leakages of foreign exchange in Fiji. The high import bill from the tourism industry represents a key shortfall between the tourism industry and landholders.

Box 5: Rebranding Savusavu to Encourage Eco tourist Visitation and Support the Delaikoro Protected Area

A range of strategies can help build Savusavu into a sustainable/eco destination and support the Delaikoro Protected Area. First, building stronger linkages between the tourism industry and rural smallholders which can occur through a range of measures such as: enhancing and protecting ecosystems that tourism operators are reliant on through sustainable agroforestry demonstration gardens and, supporting rural smallholders to grow high quality produce and access the tourism market.

Some key challenges for Savusavu that need addressing in order to increase tourism to the area are: limited occupancy levels which is suggested is due to the air capacity of Savusavu airport; the lack of sufficient revenue for many operators to market strongly on an ongoing basis and to attract new and expanded markets; disconnection from local communities and the tourism industry; lack of coordination and collaboration of many tourism stakeholders; the current branding (spectacular Savusavu) appears to have a mixed response from many stakeholders; spectacular does not really represent sustainable/eco-tourism.

Opportunities for encouraging ecotourism to the Delaikoro Protected Area exist such as promoting the drive from Labasa to Savusavu by developing tourism products and accommodation along the attractive scenic route though the Delaikoro Protected Area. By developing more products such as cafes, tours and accommodation more tourists could be encouraged to want to travel from Labasa to Savusavu which also addresses the limited capacity of the Savusavu airport. Rebranding Savusavu to show its strengths by clearly differentiating itself from the other mainstream but high profile tourism locations in Fiji could also increase visitation to the area. There would be a need to focus more on

creating a collective sustainable marketing proposition which all operators could effectively buy into and where all industry operators and investors are prepared to support it and work collectively to achieve shared goals and vision. And finally building stronger commitment and trust from all industry and wider stakeholders including the community by creating stronger linkages. A key way to strengthen these linkages is to promote local ingredients as a strategy to increase the demand for local fresh produce. “Food can contribute to a region’s attractiveness, sustain the local environment and cultural heritage, as well as strengthen local identities and the sense of community. Food experiences can also stimulate local development, since food tourism is a high-yield market that attracts a new category of visitor” (FAO, 2016).

Payments for ecosystems services and FPAM sites.

Payments for Ecosystems Services (PES) is an environmental financing framework which seeks to create performance-based payments to stakeholders who protect and enhance ecosystems that support wellbeing and generate environmental services.

The aim of these projects is to provide investment to support the maintenance and enhancement of ecological infrastructure.

Community Issues for non-wood forest products and forest protection-

- Communities are expanding and demanding more food and ready cash income while labour is declining as young people move away and the need for more ready cash increases within households
- This causes ongoing issues with agroforestry and traditional growing systems because of intensification of existing better sites and the need for new areas of reasonable fertility, usually a forested or regrowth area, leading to more clearing of what forest is there, including forestry encroachment
- Soil fertility decline from cash crops such as Kava and Taro is not addressed by replacement of nutrients through sufficient organic or inorganic fertiliser and the assumption that a few years of fallow will restore full fertility is not correct after intensive crops such as taro and kava
- There are no succession plantings of medium and limited planting of longer term crops because of the pressure for cash crops and food security as labour is limited hence

maintenance time for such plantings is necessarily limited and then these do not get planted and the cycle continues

- Planting succession crops such as banana, pineapple, coffee, cocoa, turmeric, coconuts, mango and citrus means there should be a commitment to maintaining these; the cost of investment, the land tenure issues and the availability of good planting material is limited. Markets for these crops also need to be identified with transport and logistic support.
- Opportunistic logging for long term forest trees such as Vesi continues and is not well regulated while other opportunities for the forest use such as eco-tourism and non-timber forest products are not recognised or exploited within many communities.
- Breaking this cycle will take a concerted effort to demonstrate the value of medium term crops within the systems and the return must be there for these crops.
- Non-timber forest products also must be financially attractive without being a large labour burden over time
- The value of agro-tourism and eco-tourism is being recognised by some communities and this recognition is important in non-timber forest products because it provides a rationale for preserving forest areas and forest reserves and areas of higher conservation value.
- Planting the medium cycle crops such as coffee and cocoa as part of a tourism venture enhances the value of the tourism experience and are relatively easy to exploit if the area is accessible because existing resorts are trying to find this type of experiences for their clients to add to their business as well.

Ecotourism moves forward in Fiji

The magnificent Nabalasere Waterfall

05/10/2015 Suva, Fiji The Global Environment Facility - Pacific Alliance for Sustainability Program 4 (GEF PAS 4) Forest and Protected Area Management Fiji Project is supporting the development of the Nabalasere ecotourism venture in Fiji.

Villagers from Nabalasere have established an ecotourism venture with a magnificent waterfall as its main attraction. Nabalasere waterfall is an extension of the water system that begins from Mount Tomaniivi, which is the highest peak in Fiji.

Nabalasere is one of four village communities under the "Greater Tomaniivi" project site that have contributed 347 hectares of communally owned forests for protection.

In August 2015, a 2-day training workshop was held in Nabalasere village on "Trail Construction and Development". Mark Symons of the Department of Conservation, New Zealand conducted and as part of the training led the survey and assessment of the trail leading to the waterfall.

Representatives from various tourism sectors joined Nabalasere villagers for training. The officers were from the Department of Forests (Parks and Extension), the Sigatoka Sand Dunes, Abaca-Koroyanitu Parks, Navai Village Tourism and Conservation International Fiji.

The trail construction and upgrade work is scheduled to commence in October. Other infrastructure development will include the construction of a visitor's rest and changing room and information centre. Other forms of support towards the development of the Nabalasere ecotourism venture will include: the erection of signage at strategic locations from the main Kings Highway leading to the village; training and capacity building for the villagers in business management and standards; promotion and marketing.

The overall objective of the GEF-PAS is to increase the efficiency and effectiveness of GEF support to Pacific Island countries, thereby enhancing achievement of both global environmental and national sustainable development goals.

FAO provides technical assistance towards improved management of conservation and protected areas in Fiji, Vanuatu, Samoa and Niue.

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Traditional Fruit and Nuts

Background

Fiji has a wealth of fruit and nut trees that have potential for development for local and export markets, yet very little scientific work has been done on these important local species. There is considerable interest in Fiji in replanting these native species for both food security and livelihood benefits across the islands. These traditional species are well adapted and have multiple traditional uses. However, planting material is not generally available for planting on a semi-commercial scale and seedlings do not always grow true to type in cultivation. Information on these is available in a general botanic framework but not in a horticultural or agroforestry framework to make selection of better quality planting material possible. Local knowledge is important in locating superior material and objective assessment is needed make best use of this information.

Some recent research has been undertaken in breadfruit where there are some collections of key varieties and those which are generally not well preserved or characterised to make propagation viable and to compare fruiting qualities. This need for propagation materials also applies to many introduced species such as avocado, citrus, mango, coffee and cocoa that has become naturalised across the islands. Some of this produce is sold in local and export markets, generally propagated from seed without proper assessment and or selection for quality. There is a clear need for vegetative propagation materials to maintain superior lines. This opportunity to select superior lines in a range of species will help secure and maintain livelihoods, food security and market potential.

TARGETTED SUSTAINABLE LIVELIHOOD SPECIES

- Tahitian Chestnut *(Inocarpus fagifera)*
- Breadfruit *(Artocarpus spp.)*
- Tavola *(Terminalia catappa)*
- Dilo *(Calophyllum inophyllum)*
- Vutu (*Barringtonia edulis*)
- Avocado *(Persea americano)*
- Citrus species hybrids *(Citrus grandis, C. paradisica, C. reticulata, C. sinensis, C. aurantifolia, C. limon, C.limetta)*
- Coffee hybrids *(Coffea arabica, C. canephora, C. liberica)*
- Cocoa hybrids *(Theobroma cacao)*

Similarly, projects aimed at revegetation and reforestation to combat erosion and flooding would be able to source better planting material for key fruit, nut and timber resources to provide land owners, government agencies and future projects with superior varieties for local, national, and export markets.

Scaling up approach for indigenous fruit and nut species

A collaborative effort is required to provide a strategic collection, testing and selection process to build a clear picture of the best varieties of local fruit and nut species in Fiji. These key food producing species need to be selected for adaptability, quality and yield. This selection process is needed to build a strong local knowledge and genetic resource base for these desired plants. Once selected, these can be preserved and propagated and built into a collection for further propagation and distribution.

This requires a 3 to 4-year timeframe starting with a few species to assess yield and quality of fruits, nuts and horticultural attributes based on objective criteria throughout the year. Superior lines would be selected and the original trees marked and preserved in situ to be used for propagation. Propagated plants would then be planted in budwood and nursery blocks for further propagation and distribution.

Identification of key genetic resources in traditional fruit and nut trees in Fiji

Fiji has a long tradition of selecting superior varieties of key local fruit and nut species as an integral part of the complex traditional and culturally based agricultural, agroforestry and sociobiological systems. But the appreciation of this process in the research and development sector is not well developed. To address this lack of research, a program that evaluates key traditional indigenous fruit and nut species is proposed. Starting with a focused coordinated effort to follow the seasonal flow of fruit and nuts across the FPAM locations to ensure the widest possible overview of target species. This can be followed by objective assessment in situ of quality and horticultural attributes of two to three key nut crops; *Inocarpus, Terminalia* and *Barringtonia*. Selections would be tagged; GPS marked and followed through for two more seasons and propagation material selected from the best selections used to build a collection. The selections would be characterized and this information would be prepared for general distribution. The propagation material would be available for nurseries (government and private) to build numbers and distribute as needed. A small team and transport is needed with basic location, characterization, and testing equipment (such as GPS, refractometer, electronic balance, secateurs, labels, camera) to undertake the work, initially focused on a few indigenous and introduced species.

Fijian Fruits and Nuts- Planning for the Future

In the longer term, this selection of Fijian fruits and nuts would be the basis for a wider genetic resources programme to build on the local adaptation and resilience of the plants used across the islands. This would provide the necessary information and a genetic resource to address resilience regarding climate change, build livelihoods and support rural development in Fiji as well as improve food supplies to urban areas. Similarly, import substitution and possible regional and export markets could be developed. Training in propagation would be provided to collaborating staff to utilize moving forward. An understanding of objective characterization, propagation and utilization of genetic resources would be built into the programme for ongoing use by staff and collaborators.

Economic development in the Pacific Island Nations will be well served by the focus on high-value, low-volume crops with little overseas competition (Evans, Bourke and Ferrar 1996). The growing of exotic fruit and nuts in Fiji has been challenging in both technological and managerial basis, therefore there is a growing awareness in the commercial opportunities for indigenous fruit and nuts. What follows in this section is an assessment of the key species that may be suitable for inclusion integrated planted systems in the areas adjoining the FPAM areas with a range of shorter-term crops for the generation of early income for rural smallholders.

Breadfruit (Artocarpus heterophylla)

Breadfruit is a multipurpose tree crop that is grown primarily for the nutritious starchy fruits and for the seeds (nuts) that are a source of protein. However, various species of breadfruit are also valued for their leaves, latex, bast (inner bark used for making tapa cloth) and timber. In Fiji, a breadfruit collection has been undertaken through an ACIAR project and although this has not resulted in planting material being readily available to farmers as yet, The ACIAR research has provided an opportunity to understand the potential markets and the selection of varieties for deployment in demonstration sites. Documentation of variations and uses of breadfruit is wide and the ethnobotanical importance of this species has been often discussed in the scientific literature, but the cultivation of the species is still not well developed for broader markets or export. Similarly, CEPAC has undertaken tissue culture of breadfruit from different sources and this material is planted on government research stations but is not generally available. Breadfruit can be grafted onto seedling rootstock and onto other *Artocarpus* spp. to induce dwarfing.

Breadfruit are an excellent food source and a versatile tree having different fruit types and fruiting times. Seedless types are vegetatively propagated form root cutting and a wide selection of seedling and seeded types are available. Seeds are also used and are nutritious hence there is a potential for both seeded and seedless types. The current propagation is limiting as are selections with defined characteristics for specific uses.

Breadfruit have food security benefits, a good local market and export markets and as such are a fruit that can planted on and in forest margins with immediate benefits if more propagation material were available. The diversity, spread of fruiting, value of flour from seed and other useful characteristics need to be explored and clearly documented to increase the value of the crop to local communities and build markets with quantities of product.

Ivi- Tahitian Chestnut

Ivi (*Inocapus fagifer)* is a medium to large tree that is widely distributed across the Pacific Island Nations that provides valuable food resources. Ivi is suitable for a range of environments from near tidal zones to 500m elevation, but is generally found at low elevations along water courses. In both Delaikoro and Taveuni, Ivi has a very significant role to play food security and has good potential for livelihood benefits for communities adjoining the FPAM areas.

Ivi has a Moderate – High potential for pro-poor development and the product is sold by communities who have these grown in their land (most "wild harvest"). The kennel is the primary product and in Fiji it is estimated that around 35 mt are sold in the domestic market annually, fetching about US$$28,000 or $ US0.80 / kg (Pauku, 2006). Fiji's has an export market mainly to New Zealand) and the demands according to some exporters are still yet to be fully met. From the 3 Nadi based exporters surveyed in (December, 2016) it was revealed that each of them exported around 3-5 tonnes in the last year.

Traditionally, Ivi was collected from the ground when it reached maturity stage. However, with the current market demand and more communities are climbing the trees to harvest the matured fruit/nut. This is experienced mainly in the main Ivi plantations in Ba province. Current ACIAR Agro-Forestry project is focusing on developing the Ivi production and processing with one of the major international hotel chain based in the West of Viti levu. The project would also aim to be a catalyst in replanting as all the current productions are wild harvested. In addition, the Ministry of Agriculture both research and extension are also promoting the product.

The income derived from Ivi (edible nut) is part of the revenue source for communities within a given year. The other sources would include mangos (also wild harvest), other excess from home gardens and fisheries products (fish, prawns and crabs).

Ivi could be classified as an "underutilised crop". It is marketed mainly by Indigenous Fijians, but consumed by a wide range of other ethnic groups. It is mainly a tree crop that is harvested and commercialised by women.

The wide distribution (Pauku, 2006) of Tahitian chestnut (Melanesia, Micronesia, Polynesia, extending westward to Johore in Sarawak and Sabah in Malaysia) also means that its domestication could potentially lead to demand from those who already know the product (local populations that have migrated) from the market perspective. Within the Fijian context Ivi is a common species found in almost all the villages in the littorals and also inland (to a lesser extent) in Fiji.

There is good potential for increasing incomes through increased planting, productivity, and improved market access. Farmers, through good on-farm management including new variety selection, pest and disease control and harvest and post-harvest handling, can ensure the production of good quality Ivi. Currently the local market price for Ivi fresh F$ 1.50 - $ 5 per kg and approximately double to triple this price when boiled and sold on road sides. A family could be getting approximately $200 per week from the sales of boiled product when in season. With increased planting production levels will increase as current levels are based on wild harvest.

Agro-Ecological Benefits of Ivi (Tahitian Chestnut)

- Excellent carbon sequestration potential- Typically grows to 20m in height with a crown diameter of 4-6 meters.
- Stabilises fragile environments that are key habitat for freshwater and marine ecosystems- Grows at elevation of 0-500 m although is found most commonly at low elevations along the shorelines and rivers; mean annual rainfall 1500 to 4300mm.
- Associated with lowland secondary forest, stream banks, swamps and marshes, mangroves, and coconut plantations.
- Grows in a wide range of soils with pH 5-14
- Growth rate is up to 2 meter per year

- Yields up to 75 kg fruits/ tree/ year (fruiting begins after 5 years but some bear fruit on the third year). This yield estimate is for 400 stems/ha.
- No thinning is necessary if wide enough spacing is used, unless trees require replacement due to infertility.
- Weeding is crucial at an early age (first 2-3 years in the field). This will be reduced to once a year as the trees mature (mainly for vine removal).
- Can be used as a component of a multi-story planting, both as middle story or over story tree
- Suggested spacing is 5x5 m or 400 trees / ha and a 1 hectare block can potentially produce 4-30 metric tonne of fresh fruits per peak season.
- In Fiji two season are reported (one close to Easter and one just before Christmas around October-December)
- On the crop to tree interactions, an interaction does exist between the species in terms of shade, shelter and the improvement of soil structure. Spacing of 10mx10 m or 100 trees/ha has been suggested in mixed species plantings.
- Protects vulnerable areas adjoining tourist infrastructure- Coastal stabilization, soil stabilization, crop shade/over story. Chestnut stabilises soils along the river banks and prevents rapid erosion and this has been observed in Pohnpei and Nandroumai, Fiji.
- Ivi-Tahitian chestnut is a leguminous, therefore it can help to increase nitrogen levels.
- It is not considered invasive.
- It is adapted for mixed or singles stand species woodlots for the provision of edible nuts, medicinal products, and wood for handicrafts
- The tree provides a good wildlife habitat for some nesting bird species.
- It was used in the Solomon Islands to slow down the shoreline erosion.
- The trees are also used for traditional medicine, firewood and for crafts and tool handles, canoes, and light construction.
- Bees forage on flowers and act as pollinators during flowering season.

Government/Provincial Programs and Priorities for Ivi

Ivi- Tahitian chestnut could be classified as a neglected and underutilised crop and could be a future key strategic crop for Fiji and other pacific countries. Even though at the national level it has not been seen to be very strategic but it is different when it comes to sources of income for communities where it still exists. The market potential both for the local and export market is strong. Agro-Forestry is now an emphasis in the Ministry of Agriculture Strategic Policy (2020) and within this system the species is

very important. The food security potential is very high, given that these low lying forests can be very challenging for sustainable food production

ACIAR has covered the species in a policy project and the current agro-forestry project is focusing on the species. Other projects that have carried out some work with the species include the Conservation International in their planting program in Rakiraki.

Potential for Improving Market Access

Ivi export market exists and demand is still not fully met according to recent rapid survey carried out on a few exporters based in Nadi and Ba. In addition once the market is aware of the product it could be traded in Oxfam Australia Trading and Trade Aid in New Zealand (Craig Johns, 2016) targeting the following :

- Ethical retailers – Business model built on consumers who want to hear stories about livelihood benefits
- Fair Trade Certification not essential but the story that links back to the producer is important

While the local market mainly focuses on road side sellers and the local municipal market, hotels and supermarkets have not been targeted where potential is yet to be exploited. According to Pauku (2006) the domestic market could be increased if processing technology to improve the shelf life of the kernel is developed.

Potential for Post-Harvest Productivity/Value-Adding

- Value adding through fresh produce processing and drying would add great value to the sector and provide more employment opportunities.
- There needs to be more support for research into adding value to the raw ivi so that additional benefits are retained.

IN PACIFIC ISLAND COMMUNITIES, THERE ARE LIMITED OPPORTUNITIES TO EARN INCOME, ESPECIALLY FOR RURAL WOMEN WITH CHILDREN WHO FIND IT HARD TO TRAVEL FAR FROM HOME.

(Value adding through expanding drying and processing facilities would add greatly to the economic potential of the sector and provide more employment opportunities, particularly for women, who are currently engaged in the collection and selling in the existing local markets.)

Tavola

Tavola (*Terminalia catappa*), or tropical almond, has been identified as an excellent agroforestry tree species for Fiji and similar areas of the humid tropics and subtropics (Thompson and Evans 2006). Tavola has been identified by the as a priority species across a range of Pacific nations for its rapid growth, resilience to strong winds and wide range of uses in agroforestry systems. Tavola is a nut tree with significant livelihood benefits for both Deliakoro and Taveuni, but was also found in the buffers adjoining the Tomaniivi at lower elevations that has the potential to provide a range of benefits in the buffers and conservation corridors/ revegetation of degraded or disturbed areas of the protected areas. Tavola can also provide shade and shelter for other crops including coffee, cocoa, vanilla and shade tolerant spices, such as cardamom, ginger and turmeric.

Tavola produces edible nuts, medicines and timber. Whilst the timber is highly regarded in Vanuatu (Tungon pers comm 2012), the wood is used for construction, furniture, flooring and handicrafts. Despite the potential of this species, there is currently very little information on the nut production, growth potential, silvicultural management or the economic potential of this very resilient species

Indigenous nut trees have been an important part of complex arboriculture, agriculture and sociobiological systems across the South Pacific (Evans et al 1994). The importance of nut trees in the South Pacific is destined to increase as the region experiences rapid growth in population, urbanisation and increasing demand for income diversification. Planting of tree crop species, such as Tavola, in reforestation programs, has the capacity to deliver a diverse range of goods and services, including timber, food security outcomes and a broad range of ecosystem services; biodiversity conservation, maintaining water quality, mitigating flood damage and carbon sequestration. Whilst many of these benefits have tangible direct economic values, timber production is of particular interest for developing economies as it can provide a much needed source of foreign exchange. The wood of Tavola is important traditionally, and is used in the building of canoes and artefacts (Walter and Sam 1994).

Figure 5 Terminalia catappa at 4 years in Vanuatu

Vutu

Vutu (*Barringtonia edulis*) is nut tree species that is grown widely in traditional gardens in Fiji. The nutritious nut is an important supplementary food source and is traded at local markets. Vutu is referred to in other part of the Pacific as "cut nut" and is closely related to *Barringtonia procera*, which is also an important traditional nut crop across Melanesia. The nuts can be eaten raw or roasted, and are often included in a range of traditional recipes. Vutu is a small tree with excellent potential in mixed horticultural systems, where this productive and useful species can be grown with other crops. Despite the potential of this species, there is currently very little information on the nut production, growth potential.

Vutu is suitable for a range of sites in both the Delaikoro and Taveuni up to 5-600m elevation. Vut could also be a key multi-purpose tree for planting below 600m in the buffers adjoining Tomaniivi FPAM areas.

Figure 6 Project team inspecting nursery stock for key horticultural crops including traditional fruit and nut species on Viti Levu, Fiji

Dilo

Dilo *(Calophyullum inophyllum*) is an important traditional medicinal tree found at low elevations across Fiji and the Pacific. This large tree is found on the coastal areas and riverine environments up to 200m (Friday and Okano 2006), and has been prised for the oil that is extracted from the nuts. Dilo oil has been used for medicines and cosmetics and is exported from Fiji at present and represents an opportunity for livelihood benefits in many remote areas, where collection of nuts and oil pressing are carried out. There is a great deal of variation in the oil properties across this species and grades of oil with different properties. Wood from this hardy species is also highly prised for furniture, carving and handicrafts.

Box 6. Reforestation and Improvements in Catchment Function

When forests are removed and the land is used for agriculture or other purposes, we observed that the …soils no longer absorb all the rain', explained Lisa Tanika, who is the World Agroforestry Centre's hydrologist in Indonesia, 'whereas agroforestation, which returns trees to the landscape, can induce a restoration of hydrological functions but it will take 5-to-10 years to see the effects'.

The findings come at an appropriate time, following on from a recent, ground-breaking symposium that brought to the world's attention the importance of forests and agroforests in the production of atmospheric moisture, a role second only to the world's oceans in the global water cycle.

(http://blog.worldagroforestry.org/index.php/2017/05/11/agroforest-landscapes-to-reduce-the-risk-of-floods/)

Horticulture provides a major opportunity for communities in and around the FPAM areas to improve livelihoods whilst retaining or enhancing tree cover. Even within conventional cropping systems, the inclusion of horticultural tree crops can improve soil protection and income diversification, particularly for women. As well as helping to grow food crops, women have traditionally collected and sold (or prepared for home consumption) a range of plants and plant products, including green leafy vegetables (such as *ota* - ferns, taro leaves etc.) and fruits and nuts (*kaivika* – Malay apple, *tavola* – sea almond, *ivi* – Tahitian chestnut, etc.).

Coffee

Coffee was introduced to the Pacific islands as a commercial plantation crop in colonial times and is still grown in this way in Papua New Guinea (PNG), Vanuatu and Tonga. Elsewhere, for instance in Fiji, coffee has 'escaped' from plantations (in many cases now abandoned) and become established in areas of secondary and natural forests, where it has been adopted into the traditional system (as above) and is wild-harvested (mainly by women) and sold as a source of cash income.

Many of these wild-harvested products are sold in small quantities by women along roadsides or in village markets. For others, formal value chains are developing (for instance, supplying *ota* to urban wet markets and supermarkets, or *ivi* to commercial processors for export). Similarly, some local businesses, such as Bula Coffee (Fiji) and Aore Coffee (Vanuatu) are seeking to build value chains and markets based on the limited supplies of 'wild-harvested' coffee.

Box 7: Wild Coffee Supporting Women's Livelihoods in Nandroumai Village

Women at Nandroumai village (near Sigatoka, in Fiji) currently harvest about 10kg per day, for which they receive FJD2.00/kg. In a plantation setting, a harvesting rate of around 100kg/person/day would be considered satisfactory. Evidently such a harvesting rate would not be attainable by wild-harvesting from low-input coffee in unmanaged forest. However, through some improvements in husbandry (shade management, thinning of coffee bushes, pruning etc.) productivity and ease of harvest might be improved; a harvest rate of, say, 40kg/person/day might then be achievable and would be appreciated by women as a significant improvement in the return on their labour.

Similarly, improvements in production and value chain organization would help coffee based enterprises to collect larger and more predictable quantities of fresh coffee cherry – which would facilitate processing, resulting in greater cost-effectiveness and higher quality. Research activity currently being undertaken by the SCU Project Team, has focussed on Coffee Genetics and Quality in Fiji (and Vanuatu) that offers an opportunity to establish local enterprises, such as Bula Coffee, to be developed at each of the FPAM areas. Provincial government, community and agricultural extension personnel could be briefed on the potential of current coffee production systems (genetics, quality, potential for scaling up), where to obtain better-adapted lowland and upland coffee varieties for each of the FPAM locations and how value chains for smallholder-based lowland coffee can be successfully developed (based on experiences elsewhere, for instance in Indonesia).

Each of the FPAM areas has good potential for coffee production given support and training. Coffee has been planted within the vicinity of each of the FPAM areas in the past. If Coffee ids to be pursued, capacity building will be important for developing coffee enterprises in the FPAM areas, not just ensuring farmers have good quality varieties, ensuring they will also understand the post-harvest handling and storage. In each of the three FPAM areas, communities would benefit from a selection of varieties that suit the climate and topography. To support coffee enterprises imports of some promising materials can be negotiated, then nurseries could be established and the process of incorporating new coffee genetic resources into formal and informal agroforestry systems could be initiated.

This strategy is in line with FAO priorities, especially 'promoting prosperity', 'engaging the private sector', 'reducing poverty', 'empowering women and girls' and in its focus on the conservation across the 'Indo-Pacific region'.

Coffee Varieties, Value Chains and Production for Fijian Agroforestry Systems

Coffee has become naturalised in Fiji and has also been included in agroforestry systems across a range of varieties, this includes *Coffea arabica*, *C. canephora* and *C. liberica. C. arabica* is a naturally occurring hybrid and is the only assigned species that is considered self-fertile and the main commercial variety; *C. canephora* is commonly known as Robusta and is used primarily for instant coffee, as is *C. liberica* in small amounts. Arabica is generally considered to be higher quality with lower caffeine levels than the other two and all develop distinct flavour/quality profiles.

C. arabica will produce good crops grown as a single planting while the other two need cross pollination. It is considered less hardy than the others and is usually grown at higher altitudes, commonly with light shade although higher nutrient levels and supplemental irrigation compensate for shade to some extent. *C. canephora* and *C. liberica* will grow without shade and are usually larger shrubs than arabica. All are known to hybridise and it is difficult to tell them apart in the field at times because the leaf shape and size can vary. However, the strength of the plants in naturalised populations is a major plus in selecting for local varieties with good adaptation provided the quality is good.

COFFEE AS A COMMODITY IS A MARKETABLE PRODUCT AS ARE SPECIALITY, SINGLE ORIGIN AND GREAT STORY PRODUCTS SUCH AS SMALLHOLDER COFFEE. BOTH FIJI AND VANUATU HAVE SUCH OPERATIONS THAT CAN BE BUILT UPON FROM AN AGRONOMIC/LIVELIHOOD AS WELL AS AGRIBUSINESS MODEL.

Livelihood Opportunities for Coffee in FPAM Areas

Building coffee value chains for smallholders /communities, as well as agribusiness and private sector partnerships in Fiji. These include:

- Unique coffees from naturalised or "wild" coffee that would benefit local communities and individual farmers in building livelihoods and capitalising on the existing genetic material

within their areas. This needs a support process and links to partners such as coffee roasters to find and exploit markets.

- Improving existing quality and building better production from existing producers by improving agronomy, harvest and postharvest practices to ensure that value chains are maintained and expanded. This needs to be undertaken in conjunction with known markets and partners.
- Initiating a programme to secure known superior coffee types and test these in target locations in both countries. Vatec in Vanuatu has a coffee programme while there are a number of options for the introduction of coffee from successful breeding programs aimed at improving quality from low altitude coffee types. Apart from Vanuatu and Australia; Laos, Kenya and Malawi have potentially superior material including TC propagated lines of good quality.

Approaches for Scaling up Coffee Production

Unique coffees from naturalised or "wild" coffee need to be assessed using a standard method of collection, pulping and storage with independent quality testing so this material can be utilised or kept separate from the value chain. Genetic testing would also be beneficial, especially for lines identified as superior or worthwhile. The initial work would be to collect and process samples with subsequent quality testing across areas of known populations. This must be approached with an open mind as it is not possible to predict where the best material will be found. Genetic testing would clarify parentage that would also inform on improving production. Similar work is currently underway in Australia to look at diversity and quality in localised population in northern NSW.

Improving existing quality and building better production is a process of capacity building across the groups in the field as well as a focus on capturing and preserving quality of coffee to obtain the best returns. This requires a detailed analysis of the existing supply chains to find areas where interventions would make a difference. Interventions could be in many forms from agronomy, capacity building, equipment and processing, and improved planting material.

Initiating a programme to secure known superior coffee types is a longer-term process although coffee is relatively quick to come into production. There are many collections around the world and seed could be moved readily as coffee is already moved in parchment (in testa) or as green bean around the Pacific commercially. Coffee can also be Tissue Cultured and moved in that way to minimise biosecurity risks. Southern Cross University Plant Sciences has recently signed an

Memorandum of Understanding (MoU) with World Coffee Research to become part of the testing for the International Multi-Location Variety Trials that could provide access to material from around the world of TC indexed superior lines.

Importance to the Agroforestry Value Chains Activity

Coffee is already familiar to many of the communities in although it may not currently provide an income or livelihood stream. As a crop and product, there are established buyers and roasters in both countries that would like to source better quality material locally. Similarly, as an understory crop with a relatively quick flowering time, this crop can be integrated into a range of locations and environments to support livelihoods and provide environmental benefits. Coffee can provide a medium to long term crop and livelihood for communities that can have defined markets less affected by commodity cycles and that can recover quickly from disasters such as cyclones.

Both Fiji coffee and Bulla coffee have developed markets that rely in part on imports. Moving this to local supply would have significant impacts on suitable communities and build local value chains. This work would be the underpinning for this effort that both are groups are interested in and are pursuing from different approaches. Further funding is needed to capitalise on these opportunities properly.

Fiji currently imports around $2 million USD worth of coffee each year for the local market, primarily the tourist market and this does not include the instant coffee and coffee mixes in super market/shops in the local market. Similarly, the growth in speciality coffees for single origins and for blends is growing rapidly so this also present an opportunity. Existing businesses such as Bulla coffee are seeking to build supply and value chains locally and are introducing and testing small scale equipment for local processing that will facilitate village level postharvest handling of coffee while maintaining quality. This means that coffee in forest margins, within forests and as a planted agroforestry crop will have a defined local market through that system.

The Tourist market has two parts, one is the resort and café market serviced by coffee machines and attached supply of coffee (the main import use for coffee beans currently) and, the take home market (in the longer term the repeat buy via the internet) for specialty Fiji coffee. These markets are growing and the potential for import substitution is very high because the usual supply from PNG is becoming less reliable in quality and quantity so producing locally with a few different locations to increase resilience make very good business sense.

COMMUNITIES ARE FAMILIAR WITH AND CURRENTLY HAVE MANY USES FOR BAMBOO, SO UTILISING BAMBOO AT THE LOCAL LEVEL COULD BE ENHANCED WITH NEW MATERIAL.

As a resilient crop, Fiji could produce coffee from sea level to higher altitudes for different markets and uses. This crop recovers quickly from cyclone damage and requires limited work in the field once established and is forgiving in terms of immediacy for activities such as harvesting although birds are attracted to the ripe fruit.

Bamboo

Bamboo a multi-purpose plant depending on the species. Bamboo is useful as a food (bamboo shoots), for construction (bamboo poles and thatch) as well as possible processed products from cut stalks and, charcoal for fuel. Bamboo shoot is an exportable product with a sizable Asian population in New Zealand and around the pacific and possibly to China or other Asian countries such as Singapore that have reasonable airfreight connections with Fiji.

Bamboo is also an effective fuelwood source and for charcoal production either for fuel or as a filter charcoals source (bamboo charcoal makes an excellent filter material due to its original fibre structure that it retains after pyrolysis.

Specific varieties of bamboo are used for shoots although most are quite edible. These are clumping types that do not become invasive so could be imported through quarantine as tissue cultured plants. Once established these can be multiplied through culms or stem cuttings and planted vegetatively in situ during the wet season. Bamboo responds well to fertilisers and manures. Bamboo is a very resilient plant that recovers well from cyclones, is tolerant of drought and in most cases fire so would be useful as a forest margin plant, for wind breaks and shelter belts to protect forest margins and as a protection crop for coffee and possible cocoa.

On slopes leading to forest fringes, contour lines of bamboo could be planted across slopes as a shelter belt that would reduce erosion and provide a protected area for planting trees and garden crops such as sweet potato and intermediate crops such as coffee These would also help provide a fire-retardant

break to reduce fire intensity. Bamboo could be planted in existing gullies to hold these and reduce erosion and slow the movement of silt.

Bamboo for fibre and for building products would need the right species and sufficient scale to make it viable. However, on sloping land and for environmental benefits such as erosion control and fire breaks, the material could still be harvested regularly and sold into this market using hand labour and maintain the environmental benefit by selective harvesting while maintaining the culms intact.

Turmeric

Turmeric (*Curcuma domestica, sn longa*) is already well known in Fiji although much of the use is from opportunistic harvest of wild plants. These are often harvested after some time in the field so tend to be strong flavoured with high colour and curcumin content. There is considerable interest in turmeric as a health food (anti-arthritic and anti-inflammatory properties).

Turmeric is a rhizomatous herbaceous perennial plant of ginger family (Zingiberaceae). It is native to southern Asia, requiring temperatures between 20 and 30 °C (68 and 86 °F) and a considerable amount of annual rainfall to thrive. It is known as the 'golden spice' as well as 'spice of life'. It has been used in India as a medicinal plant and held sacred from immemorial (Ravindran, Babu, & K.Sivaraman, 2007). This root is highly revered in Ayurvedic medicine, as well as general South Asian cuisine. Native to Southern Asia, the name curcuma comes from the Arabic word "kurkum", or "saffron", and is an indication of its relationship to the vibrant orange color of both herbs. Since Biblical times, turmeric has been used to spice foods, make perfume and colour clothing.

Turmeric grows with some to minimal shade and can survive the drier slopes and margins where wild harvest currently occurs. It can be planted from rhizome pieces at the start of the wet season and does not require much attention although weeding initially would be beneficial. Turmeric responds well to fertiliser and manure, especially potassium and could be planted on raised ridges on the contour to also reduce erosion. As a useful plant in forest margins and on drier slopes that have been cleared or partially cleared and eroded, turmeric can provide a crop in around 10 months although it can remain in the ground for longer as is common in Fiji currently. This provides flexibility for the crop and for land users. Yields vary considerably and experience in Fiji indicates a low yield with opportunistic harvesting while cultivated crops can yield 13 to 25 tonnes of fresh rhizomes per hectare. As a forest margin crop, yield would be lower unless actively cultivated although the colour and concentration improves with longer periods in the soil, increasing the value in some markets.

Fiji Turmeric Market

In 2004, Fiji imported 97 tonnes of dried turmeric valued at 56,000 USD. However, according to ITC's Market Development Paper (1995), turmeric market has since grown rapidly worldwide. This is the catalyst for increase in production in India and China (Ravindran, et al., 2007). Market demand in Fiji itself is enormous and commercial cultivation will enable rural Fijian to cash in on the precious commodity. Current market price of powdered turmeric being retailed at supermarkets is FJD 12.00 to 16.00 per kg. The current annual demand is estimated to be 100 – 120 tonnes (powdered) which has estimated value of 1.4million – 1.8 million Fijian dollars.

THERE IS GREAT MARKET POTENTIAL TO SELL TURMERIC EITHER

- FRESH
- POWDERED FORM
- TURMERIC OIL

Medicinal ginger

This is a traditional medicine in the ginger family that can grow in quite heavy shade within a forest or selected cropping system such as coffee or agro-forestry and, has a ready market locally. The medicinal uses and wider market needs investigation.

Cardamom

Cardamom is a potential crop for wetter areas of Fiji and relatively easy to grow although fruiting can be an issue. It is also a soil erosion control crop and suited to open forest or thinned forest and forest margins with reasonable tree cover and where moisture is adequate. It is a tall plant up to 3 meters and can be grown with other plants such as coffee in clumps or more formally and prefers more fertile soils and wetter conditions that turmeric and ginger.

It takes up to five years to commence flowering and fruiting and the plant can continue to bear for around 10 to 15 years. This means cardamom is a crop that requires active management as part of an integrated system and that means that it is best suited to an agroforestry system. It usually takes more than one season for plants from seed to be planted into the field and harvesting of seed pods is determined by the erratic nature of maturity in the inflorescences. This is high value crop that does need a higher level of input to cultivate successfully so is a margin crop closer to villages with interested and knowledgeable farmers. Sourcing seed could be an issue, it can be planted from pieces although these might be a bio-security /quarantine issue.

Galangal

Galangal is a close relative of ginger and can grow within forests and forest margins. Galangal is useful as a contour plant and will grow in full sun as a forest fringe plant and as a plant to line paths and delineate areas for other crops or just to hold soil and fill an area. Galangal is used in cooking as a strong flavour without the sweetness of ginger. It propagates readily from rhizome pieces and would be useful as pioneer species in some sites for soil protection and erosion control and as a shade protection for tree seedlings with appropriate management. It has local market for use in cooking and possibly in New Zealand and other Pacific Islands

Cocoa

Fiji used to have a significant cocoa industry and still has the genetic resources to build back into an important smallholder crop and a value adding industry. There is an increase in interest from community as well as commercial farmers for cocoa emerging in Fiji, in part driven by the specialty cocoa market for single origin and unique cocoas as well as the decline in supply of cocoa around the world due to impacts of climate change and, in west Africa by conflict and disease outbreaks in the crop and within communities (such as Ebola in Sierra Leone and Liberia).

Vanuatu has demonstrated that islands like Vanua Levu and Taveuni could produce unique cocoa and can reinvigorate its cocoa production. The introduction of solar drying approaches and different growing systems has helped improve livelihoods, as has outside technical support.

Cocoa is best grown with some shade and is best suited to forest margins and agroforestry systems in lower altitude areas of Fiji. Excess shade is not good so an open canopy with high tree cover is best as this reduces humidity a disease pressure. It is relatively fast return crop, fruiting in 2 to 4 years from grafted trees planted in the ground during the wet season. Harvesting can occur over an extended period and postharvest handling is critical to maintain quality hence farmer training is essential for good quality production. Better technology is available for small scale production and these is a market within Fiji with an existing cocoa buyer and chocolate maker.

Figure 7 Inspecting Cocoa planted in the vicinity of the Delaikoro FPAM area

Coconuts

The coconut palm, *Cocos nucifera,* is widely grown throughout the moist tropical regions of the world. Almost every part of the coconut tree is used and it is often referred to as the 'Tree of Life'. Coconuts are predominantly grown by smallholders, with approximately 70 per cent of production being derived from properties of less than 2 ha. The coconut provides the small farmer with most of the essentials of life, including a source of cash. It forms an integral part of the functioning of local communities, particularly small island communities, and supplies a major source of foreign exchange for many countries.

In the Pacific region, large areas of coconut palm have grown senile, and copra yields are greatly reduced as a consequence. There is an opportunity to improve the performance of coconut production by targeting new markets (coconut water) and integration of coconuts with other crops Coconut tender coconut water is fetching $2/nut on the roadside. Even though no data is available for this, it appears the number of road side vendors for the product is increasing. The product is yet to appear in supermarket shelves and there is also a market with the hotels for welcome drinks and in restaurants. An earlier survey in hotels showed the coconuts being sold for $5 per nut. Today could also be produced from coconuts and one of the new products now found in the markets is coconut sugar. This is good for diabetes.

According to ACIAR research into Cocowood veneer production (ACIAR FST/2004/054), *the cost of clearing senile palms are real impediments to replanting. Production of flooring material from senile stems has been proposed as means of clearing the old plantations while generating some income. There is very high demand for flooring products in Asia, America and Europe - the US market alone is forecast to grow by 40% in the four years to 2008. Generally however, while market demand is increasing, the supply of suitable resources is decreasing, particularly for hard, dark timbers from sustainable resources* (ACIAR 2017).

The following information is an example of the process of establishing a business case for integrated cropping and coconut value adding for the Taveuni and Vanua Levu context:

Vision and Goals

Table 1: Vision and Goals for coconuts in Fiji

Vision Statement		**To have a profitable & robust agribusiness venture that also takes care of the natural environment.**
Goals	Short Term	
Production		
	10 acres of land cleared, ploughed and planted with cassava @ 1 acre per month	
	10 acres of coconuts in 2-3 years successfully established and maintained.	
Marketing		
	Carry out a market survey and establish 5-10 market links (Suva and Lautoka) for Cassava (3 months after planting)	
	Carry out market and establish 3-7 market links for tender coconut in Ba, Lautoka and Nadi initially.	
	Cultivate other lucrative and profitable cash crops in between coconuts after planting	
	Carry out feasibility study on coconut toddy sugar from the palms by the 5th year of production	
Goals	Long Term	
	Value addition in coconuts (oil, coconut water, cosmetics)	
	Commence export market for cassava	
	Develop organic farming practices	

Commodities / Product	Varieties
Cassava	Beqa, Yabia Damu, New Guinea, Sokobale, Nadelei, Vulatolu
Coconut (Tender coconut water – Bu)	Malayan Red Dwarf, Malayan Green Dwarf, Malayan Yellow Dwarf

Market: The concept is to target the local market initially before going for exports.

Cassava: The local demand and market for cassava will never run out. It is consumed mainly by the I-Taukei households as staple and, also converted into cassava chips (small quantity). Cassava has processing potential for starch based derivatives including food thickeners that has yet to be developed in Fiji.

Box 6: SWOT ANALYSIS: Coconuts in Fiji

Strength	*Weakness*

• Constant production level and good control of product quality
• Production with good and available varieties of coconuts and cassava
• Availability of Capital
• Availability of assistance (technical and financial) from the Ministry of Agriculture and the Fiji Development Bank
• Technical backup provided by SPC Coconut Expert (T.Kete)
	• Production
	  ○ Finding labour
	  ○ Non availability of hired machinery and or suitable scale machinery when required
	  ○
	• Marketing and sales
	  ○ Distance to markets
	  ○ High competition and lowering the price

Opportunities	Threats

• Marketing and Sales
  ○ Tender coconut water market (Tourist market and Supermarkets)
  ○ Value adding
  ○ Development of export markets to Australia and New Zealand
• Production
  ○ Improve production efficiency
  ○ Improvement in the transport of coconut
  ○ Opportunities for local value adding including cooking and cosmatic oil, presscake for stock feed
	• Production
	  ○ Rising input cost
	  ○ Disease
	  ○ Drought or cyclone
	• Market and sales
	  ○ Potential export market saturation

Yams

Yams are currently harvested from within forests and forest fringes and these are important food and seasonal income crops although they are essentially wild harvested in most cases. Intensifying yam production by actively planting and re-planting yams within the forest and forest margins would be an income source for surrounding villages. Yams are a healthy crop that also support nutrition and food security, especially after cyclones and act a store of food under these circumstances.

There is a growing local market for yams with the urbanization of Fiji and for traditional activities including special occasion feasts where yams are desired part of the food mix. Improving basic husbandry would increase productivity and returns from these plants as a crop. The use as a food store is underestimated and undervalued with communities interviewed after the recent cyclones indicating that yams were among the first food harvested so there is merit in increasing the planting and re-planting of yams for this reason regardless of market opportunities.

Orchids and Flowers

Flowers production offers an interesting opportunity for those communities that are located in areas adjoining tourism infrastructure, such as the Savusavu side of the Deliakoro FPAM. These can be sold directly to resorts or can become part of eco-tourism experiences where orchids for example can be planted and attached in larger numbers along paths used for tourism. Similarly, the resorts can use cut orchid flowers, particularly Phalaenopsis and Dendrobium species that are relatively easy to grow in a forest fringe environment or within a village on the forest fringe. There is existing superior planting material within Fiji to use for establishment and, the local tree fern stumps are a very good host for orchids.

Others such as Heliconia's and Alpinnia's can be grown in forest margins and as an understory in logged forestry and in regenerating forests as a cash crop. While these may be better if grown more intensively they still produce well with this system but flower production overall is less, not really an issue with the reduced labour and inputs needed. Skill is still needed for selecting flowers and maintaining harvest quality and this is important for the local resort market.

Honey Production

Honey (from domesticated European honey bees) is a unique product with a specific local signature depending on the nectar and pollen sources. Apart from the usefulness in crop and tree pollination, honey is a valuable tradeable product that has multiple uses locally as food, sweetener, additive in

cosmetics and healthy alternative to refined sugar in diets. Recent developments in hive design allow for simpler honey extraction and reduce the need for specialised equipment and materials in honey production although knowledge of hive and colony care are still necessary.

Similarly, the development of other non-timber forest products such as coffee would benefit from honey bees and similarly support honey bee production. Coffee is a significant nectar source for honey and lesser source for pollen that would support increase honey production in forest fringe areas and from existing wild coffee wild coffee

Honey production in Fiji is in decline over the past 40 years and as a result imports are increasing. In response this situation donors have been looking to provide more hive boxes, however the major issues facing beekeepers and the honey industry in Fiji are much more profound than just a lack of hives, including:

- Pest and disease awareness and management is compromising existing hives;
- A poor genetic base from which to base an industry;
- A lack of appropriate technology to support beekeeping;
- A lack of capacity and support from governments;
- Limitied market access;
- Limited infrastructure to support up-scaling;
- A lack of awareness about honeybee nutrition;
- Poor post harvesting and handling;
- A lack of inclusion of women;

Beekeeping is an industry that provides the ability for economically marginalised groups, such as landless poor and rural women, to access income without exacerbating environmental and land tenure issues.

Honeybees have great potential to be developed as a niche industry with low start-up costs and the ability to scale up quickly. Bee products can be marketed through existing networks and bees in many cases improve productivity of crop-farming systems.

Numerous studies (e.g. Pala 1974, Kaur and Sharma 1991, Ogaba 2002) highlight the importance of empowering women in achieving welfare outcomes in rural development, since a high proportion of

cash income in the hands of women tends to be spent on family welfare. Income generated by beekeeping and value-adding bee products can be accessible to women, who rarely own land, have different assets, different access to resources, and different opportunities to men. With a narrower range of labour markets than men, diversification that improves the independent income-generating capacity of women also improves family welfare (Bradbear 2009, Inder et al. 2013). Empowering women through beekeeping and value-added bee products is a major focus of this project proposal.

Ginger

Fiji has been exporting ginger since the 1950s to New Zealand and North America. By the mid-1980s, ginger had become the second biggest agricultural export after sugar, with over 2,300 tonnes of mature fresh ginger sea- freighted annually to North America. In parallel to the fresh export industry, has been the development of a processed ginger industry dating back to the 1950s. By the mid-1990s, exports of mature ginger were in decline in the face of disease problems and competition (price and quality), from Thailand and China. Improvements to storage technology have enabled these large producers to export high quality fresh ginger year-round. Today, all that remains of Fiji's fresh ginger exports to North America is a very narrow, seasonal niche of baby ginger air freighted to Los Angeles in December/January.

The first major ginger processing operation began in the mid-1980s, with a joint venture involving the National Marketing Authority (NMA) and New Zealand confectionary company. Since that time, there have been a number of companies involved; with the focus on processing immature ginger that is first brined, and then manufactured into a range of value added products. Today there are three (3) major agribusiness companies involved in ginger processing. Processed ginger for export is now the industry's dominant sector, and is where the greatest growth opportunities lie (McGregor 1988).

In recent years, the quantity of Fiji ginger (fresh and processed), exported averages around 2,000 tonnes annually, with a fob value of around $10 million. In 2015, there was a significant increase in exports to nearly 2,700 tonnes with a fob value of $13.6 million. Processed ginger (mainly in syrup, crystallised, and candied), constitutes well over 90% of this total. Ginger is seen to have significantly greater growth potential than any of Fiji's other agricultural export industries.

Fiji has a comparative advantage in the growing, processing and exporting ginger products based on the following factors:

- Soils and climate.
- Seasonality.
- Pest and disease status.
- Proven processor/exporters who pull supply through the value- chain.
- A substantial pool of small farmers that can be drawn upon to increase production.
- Opportunities for organic certification
- Fiji's image and ability to supply high value markets and ability to meet increasingly stringent food safety requirements.

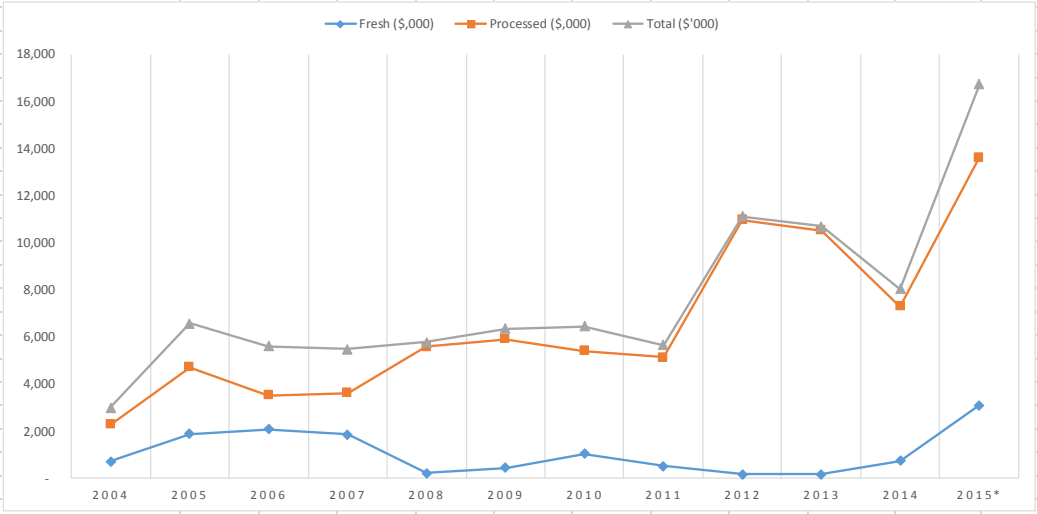
There are market opportunities for Fiji to at increase ginger product sales over the next 5-years, provided farmers can deliver the required level of production and quality. The limitations in meeting these projections are seen to lie in the supply side rather than with market demand. It is projected that at end of the 5-year Plan period there would sufficient identified demand for ginger products requiring the purchase approximately 8,000 tonnes of fresh ginger from farmers. It is estimated that around 90% of this total is for processed ginger exports with the balance shared between the fresh exports and local market sales. In terms of type of ginger supplied by farmers these estimates translate into:

- Mature ginger - 2,250 tonnes (28% of the total market requirements)of which 150 tonnes is for fresh export
- Immature ginger – 5,450 tonnes (67% of the total market requirements)
- Baby ginger – 400 tonnes (5% of the total market requirements).

Today ginger remains a major export industry. Table 3 compares the value of ginger exports with that of dalo, kava, cassava, papaya and eggplant over the period 2004 – 2014.

Table 2: The quantity and value of ginger exports: 2004 – 2015*

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014*	2015*
Fresh												
Quantity (tonnes)	236	507	469	414	44	75	161	145	9	47	145	801
Value fob ($,000)	718	1,869	2,084	1,859	204	449	1,034	510	153	160	743	3,094
fob value $/kg	3.04	3.69	4.44	4.48	4.60	6.01	6.42	3.51	16.20	3.39	5.13	4
Processed												
Quantity (tonnes)	428	873	682	809	1,334	951	831	715	1,886	1,608	945	2,764
Value fob ($,000)	2,277	4,698	3,515	3,609	5,568	5,902	5,415	5,131	10,961	10,524	7,282	13,626
fob value $/kg	5.32	5.38	5.16	4.46	4.17	6.21	6.52	7.18	5.81	6.54	7.71	4.93
Total ginger quantity (tonnes)	664	1,379	1,151	1,224	1,379	1,025	992	860	1,896	1,655	1,090	3,565
Total ginger fob value ($,000)	**2,995**	**6,567**	**5,599**	**5,467**	**5,772**	**6,351**	**6,449**	**5,641**	**11,114**	**10,683**	**8,025**	**16,720**
Value of exports												
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015*
Fresh ($,000)	718	1,869	2,084	1,859	204	449	1,034	510	153	160	743	3,094
Processed ($,000)	2,277	4,698	3,515	3,609	5,568	5,902	5,415	5,131	10,961	10,524	7,282	13,626
Total ($'000)	**2,995**	**6,567**	**5,599**	**5,467**	**5,772**	**6,351**	**6,449**	**5,641**	**11,114**	**10,683**	**8,025**	**16,720**
Processesed ginger as % of total	0.76	0.72	0.63	0.66	0.96	0.93	0.84	0.91	0.99	0.99	0.91	0.81

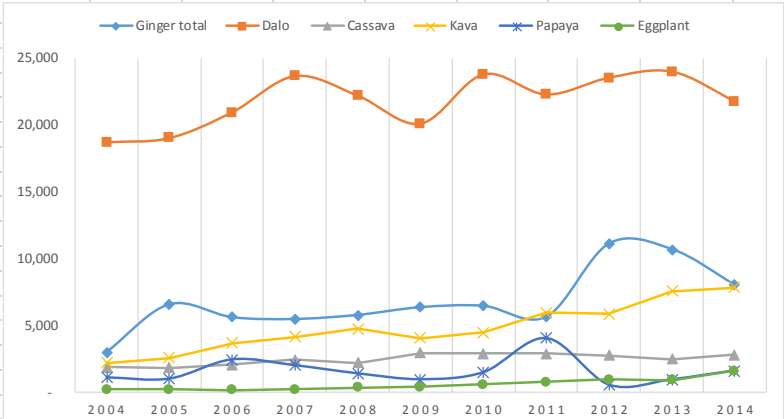


*Provisional

* Fiji Bureau of Statistics (BoS) Data supplied by Fiji Agriculture and Rural Development Section, EP&S, Ministry of Agriculture .

Table 3: The value of ginger exports compared with dalo, cassava, kava, papaya and eggplant, 2004-2014 (FJD ,000 fob)*

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Ginger total	2,995	6,567	5,599	5,467	5,772	6,351	6,449	5,641	11,114	10,683	8,025
Dalo	18,690	19,006	20,936	23,647	22,175	20,089	23,776	22,269	23,528	23,979	21,757
Cassava	1,867	1,820	2,069	2,441	2,185	2,934	2,871	2,878	2,765	2,498	2,792
Kava	2,215	2,562	3,674	4,153	4,751	4,050	4,454	5,941	5,840	7,580	7,826
Papaya	1,085	994	2,436	1,994	1,387	948	1,481	4,031	529	944	1,613
Eggplant	226	199	189	194	369	411	591	771	951	888	1,612



* BoS data supplied by Fiji Agriculture and Rural Development Section, EP&S, Ministry of Agriculture .

Livelihoods Contribution of the Industry

Ginger is a short term, labour intensive crop. In 2015 it was reported that there were over 1,400 ginger farmers, located almost entirely in the Central Division, planting around 330 ha. However, according to the buying records of the main companies that purchase ginger the number of farmers supplying ginger in any one year is less than half that number.

Table 4: The estimated number of ginger farmers and area planted (2015)*

Province	**No farmers**	**Estimated area planted (ha)**
Tailevu	141	8.4
Naitasiri	1,169	271.5
Serua	62	39.6
Rewa	40	10.3
Total	1,412	329.8

**Source: Ministry of Agriculture, Extension Division. Ginger Industry (Commodity Rpt. 1st Qrt 2016).*

The majority of ginger farmers still plant less than 3 square chains (60 sq meters approx.) at any one time, which is part of a multiple cropping system involving dalo, cassava and other short term crops. These farmers tend to oscillate in and out of planting ginger as their cropping and household needs determine. This is identified as a major strength for the development of a sustainable industry, although it does create extension challenges. The group is made up almost entirely of *I-taukei* farmers – who are either land-owners or the descendants of settlers from the outer-islands.

Market Segmentation: the Global Situation

According to FAO statistics, world ginger production stands at around 2 million tonnes, with 5 countries up around 80% percent of this amount (table 6). India is by far the largest ginger producer, followed by China. Fiji production accounts for less than 0.5% of world production. The world trade in ginger production is around 400,000 tonnes, of which India's share of exports only around 6% and China's share well over 50%. The importers of ginger are less concentrated, with United States, Japan and Europe being the major buyers. The international market for ginger is highly segmented in terms of both end product and the source of supply, with three broad categories being traded: dried, preserved and green (fresh).

Seasonality used to provide a market for Fiji fresh ginger to the United States, who at that time was importing around 20,000 tonnes of fresh ginger (FAO 2002). Fiji was supplying as much as 3,000 tonnes of this amount annually. As discussed above this market has now been lost to China and Thailand and is unlikely to be re-established in the immediate future. There would be future opportunities to export organically certified fresh ginger to the United States. Japan is by far the largest importer of fresh ginger, importing around 90,000 tonnes annually (FAOSTAT). This offers a possible opportunity for Fiji ginger if new areas can be certified free of burrowing and root knot nematodes.

The Current and Expected Future Nature of the Ginger Industry

The Fiji ginger industry over the last 30 to 40 years has transformed from one primary based on fresh mature exports, predominately to North America, to one based largely on the processing of immature ginger. This situation is unlikely to change, except for the prospect of increasing demand for mature ginger for the manufacture into paste and the possibility of organically certified fresh exports. This represents a particularly positive scenario for the Fiji ginger industry given the strong market prospects for the processed products being produced. The industry is more dependent than ever on supply being sourced from small farmers.

Fiji's Comparative Advantage in Growing and Exporting Ginger

Fiji has a comparative advantage in the growing, processing and exporting ginger products based on the following factors:

- Soils and climate.
- Seasonality.
- Pest and disease status.
- Proven processor/exporters who pull supply through the value chain.
- A substantial pool of small farmers that can be drawn upon to increase production.
- Farmers able to secure a good return from their effort in growing ginger.
- Opportunities for organic certification
- Fiji's image and ability to supply high value markets and ability to meet increasing stringent food safety requirements.

Vegetable Production

Vegetable production provides an important livelihood opportunity for communities in and around all of the FPAM areas. In the elevated of the Pacific islands, such as around Tomaniivi and in Vanua Levu, both large landholders and smallholder farmers can grow brassicas - mainly head cabbage, Chinese cabbage and watercress. According to ACIAR. the production of these crops has increased dramatically in Fiji and Samoa, where Chinese cabbage is rapidly becoming the major source of green leaf vegetable.

A survey by ACIAR of 80 farmers was conducted in Fiji (September- October 2012) to investigate understand current practices and constraints for crop management, postharvest handling/ storage and marketing. Tomato, eggplant and cabbage were identified as the three main crops. The use of synthetic fertilizers and pesticides is common, irrigation is typically by bucket or watering can methods, the major production constraints are pest damage and climate related restrictions and most farmers harvest tomato in the afternoon and grade them before transport in wooden crate. Produce is sold to middlemen (43%), sold by farmers themselves (41%) or by other vendors (16%). Prices for egg plants are stable but prices for cabbage and tomato are usually lower June- October than at other times of the year.

A soil health survey was conducted in Fiji (October 2012- January 2013). Soil samples were collected from 15 farms in the Sigatoka valley, the cane coastal area, and Koronivia and 11 soil health

indicators were assessed. Poor soil fertility was identified as a constraint on all farms surveyed and other common constraints included low organic matter, labile carbon and low soil microbial activity. The results suggest that adoption of practices to increase soil fertility and organic matter would greatly improve soil health.

Other Crops with Potential

There are several other crops commonly grown in Fiji including ***vegetables, mango, local citrus and chillies*** that could be grown in forest margins and as part of agro-forestry systems. These have established markets provided transport and logistic work. They are generally not high value and perishable so are less likely to be cultivated purposefully to increase livelihood opportunities.

Pepper (green and black) has some potential as it can be grown and harvested in semi wild state in conjunction with orchids and on palm stems including coconut or on posts made for the purpose. It does best with some protection although will survive in full sun with extra nutrition. Pepper requires a good understanding of postharvest technology by the grower for success.

Wild pepper is in Fiji including close to Ba where the plant has naturalized in semi-shaded palms and trees. The quality of this potential product is not known and production appears relatively low. This material could provide a basis for a pepper system in agro-forestry and other pepper sources would be found.

Vanilla grows readily as a vine in the wetter areas of Fiji but this does not lead to pod production. Vanilla production requires considerable understanding of the crop and delicate post-harvest handling and fermentation for success. The market is good with many traditional producing countries struggling due to climate impacts. For these types of systems, a very dedicated system and training program would be needed for success.

Chillies and Paprika are crops with good local markets and could be grown more extensively although labour for harvesting is an issue. For Paprika, correct drying is necessary to maintain quality. Bother these crops could be included in the ginger rotation with an added season as the labour requirement for picking and drying is similar to ginger. There is a local market for each as fresh product for cooking and would require transport to markets to be successful. Varieties of each vary considerably and further work is needed on these for market potential.

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