



UNDERUTILIZED SPECIES POLICIES AND STRATEGIES

Analysis of national and institutional policies in Papua New Guinea that directly or indirectly affect the use of currently underutilized species of crops for food and agriculture



Report

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Abbreviations and acronyms

CBD	Convention on Biological Diversity
DAL	Department of Agriculture and Livestock
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environmental Facility
GOPNG	Government of Papua New Guinea
IPA	Investment Promotion Authority
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
NARI	National Agricultural Research Institute
NTFP	Non-Timber Forest Products
PGR	Plant Genetic Resources
PNG	Papua New Guinea
PNGBio	PNG Institute of Biodiversity
PNGBioNET	PNG Biodiversity Network
RDB	Rural Development Bank
UNEP	United Nations Environment Programme

Abstract

The aim of the study undertaken was to analyze national and institutional policies in Papua New Guinea that directly or indirectly affect the use of currently underutilized species of crops for food and agriculture.

The report of the above discusses existing policies legal instruments and strategies – or their absence – and their effect on exploiting to the full the real potential of underutilized crops in the country. Possible strategies are proposed for strengthening national and key institutional policy and legal frameworks to enable and further the conservation and sustainable use of underutilized crop and plant species.

There is a brief overview of government policies and strategies in the various sectors, including agricultural development, food security, nutrition and biodiversity conservation, among others. In the educational sphere, mention is made of the lack of emphasis on underutilized crop species both for study and research, while a look at the research agenda of PNG's National Agricultural Research Institute (2006-2010) indicates a special focus on the country's indigenous crops. A review is made of the Government's overall Medium Term Development Strategy for Papua New Guinea 2005-2010, in which there is mention of the importance of 'traditional foodcrops' and the need for research on same. The text goes on to highlight the considerable potential for these crops in contributing to poverty alleviation and to an increase in the country's export earnings. Finally, as a result of a series of one-day workshops held in the various regions with the original intention of endorsing the results of analyses of policies and strategies emanating from the study, a set of proposals were drawn up. These proposals represent the core of a strategic plan of action, which is directed towards strengthening policies and programs aimed at making a more effective use of Papua New Guinea's wide range of underutilized plant/crop species.

I: INTRODUCTION

The National Agricultural Research Institute (NARI), in collaboration with other agencies, was contracted by the Global Facilitation Unit for Underutilized Species (GFU) to undertake an analysis of national and institutional policies in Papua New Guinea (PNG) that directly or indirectly affect the use of currently-underutilized species of crop plants for food and agriculture.

The purpose of the analysis was to explore various issues and develop mutual support in efforts to ensure that designated underutilized crop species are enshrined in national agricultural development policies, strategies and plans, for the benefit of smallholder farmers and the nation at large. The present report relates to the task of examining existing policies, legal instruments and strategies, or the absence of these, affecting either positively or negatively the improvement and utilization of the real potential of underutilized crops in PNG. The objective was to produce a fully documented, analyzed and justified strategic plan for strengthening the national and key institutional policy and legal frameworks to enable effective conservation and sustainable use of currently underutilized crop species for food and agriculture.

In the PNG context, we are assuming that underutilized species of food crops are those that are used but are not major staples. These crops, which are not part of the 'List of Crops Covered Under the Multilateral System of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) (FAO 2002)', Annex I, include:

All traditional green vegetables including Aibika (*Abelmoschus manihot*), Tulip (*Gnetum gnemon*), Aupa (*Amaranthus*), Rungia (*Rungia klossii*) and Water Dropwort (*Oenanthe javanica*)

The two Pitpits (*Saccharum edule* and *Setaria palmifolia*)

Pandanus – Marita (*Pandanus conoideus*) and Karuka (*P. julianetti*)

Winged Bean (*Psophocarpus tetragonolobus*)

Choko (*Sechium edule*)

Indigenous nuts and fruits, including Galip (*Canarium polyphyllum*), Okari (*Terminalia kaernbachii*), Pau (*Barringtonia procera*), Aila (*Inocarpus fagiferus*) and Taun (*Pometia pinnata*)

Breadfruit (*Artocarpus altilis*)

However, it is also possible to include PNG staple food crops that are not fully utilized to the extent of commercialization, export potential, downstream processing or added value and alternative uses, such as the sweet potato, taro (*Colocasia* and *Xanthosoma*), *Dioscorea* species of yam and bananas, sago and cassava, as well as coconut as a food crop.

Comprehensive descriptions of all food plants in PNG are available in French (no date). Non-food crops of interest as underutilized species can include:

Noni (*Morinda citrifolia*)

Tapa (*Broussonetia*)

Abaca (*Musa textilis*)

Rattans (*Calamus spp.*)

Vetiver (*Vetiveria zizainoides*)

Japanese Mint (*Mentha arvensis*)

Lemon Grass (*Cymbopogon citrates*)
Sandalwood (*Santalum macgregorii*)
Eaglewood (*Gyrinops ledermannii*)
Essential Oils (*Asteromyrtus symphyocarpa*)

II: GOVERNMENT POLICIES AND STRATEGIES IN DIFFERENT SECTORS

National development

The Government-presented PNG **Medium Term Development Strategy 2005-2010** is currently the definitive planning document for national development and represents PNG's overarching plan for economic and social development, firmly based on the Government's Programme for Recovery and Development. Its primary overall themes are good governance, export-driven economic growth, rural development, poverty reduction and empowerment through the development of human resources. There is a focus on recently-emerging threats to development, such as HIV/AIDS, high population growth, unplanned urbanization, dysfunctional service delivery systems and impediments to land utilization.

The Government strategy is to empower people, especially those in rural areas, to mobilize their own resources for higher living standards. The concept is that of creating an enabling environment to cater to the self-interest of smallholder farmers by delivering higher rewards for productive effort. Priorities related to agriculture are encompassed in the promotion of income-earning opportunities. This infers that there is neglect of traditional and subsistence agriculture. However, in the PNG context, income-earning opportunities derive from the marketing of traditional staple roots, vegetables, fruit and nut crops, and the exploitation of new or emerging underutilized species, as well as the continued development of the major export tree crops such as coffee, cocoa, coconut and palm oil.

While there is no specific reference to the role of underutilized crops in this context, the following statements are highly relevant – “It should be noted that many of the specific interventions aimed at promoting income-earning opportunities in agriculture, such as extension and research, will be extended to the traditional food crop sector. This policy is consistent with the Government's focus on food security and reflects the fact that over the period 2005-2010, the majority of people in rural Papua New Guinea will continue to rely on traditional food crops for the bulk of their dietary requirements. These crops are also an important source of income and are widely traded in the informal sector. Research into traditional food crops is important not only to improve yields and develop better methods for processing and storage, but also as a precaution against the onset and spread of disease. If PNG's traditional staples were affected by disease, the impact would be potentially devastating”. Hence, support for research on traditional food crops is listed as a priority. The potential of these crops in contributing to export earning, as well as poverty alleviation, should not be overlooked. Also relevant here are the assertions that protection of the vulnerable and disadvantaged, and the promotion of gender equality, are moral and constitutional obligations for the government, as is protection of the natural environment through ecologically-sensitive and sustainable development.

The Government Department of Agriculture and Livestock (DAL) is currently in the process of developing a **National Agricultural Development Plan**, following inadequate documentation contained in the National Agriculture Development Strategy; Horizon 2002-2012 (August 2001) and a White Paper on Agriculture, National Agricultural Development Policies 2001-2012. It is the responsibility of the National Agricultural Research Institute (NARI) to ensure that the new

document puts adequate emphasis on the full utilization of traditional crops, including those listed above, rather than relying almost totally on the major export tree crops – oil palm, coffee and cocoa – and on introduced grain crops for national development.

Agricultural development

Nevertheless, the **National Agriculture Development Strategy; Horizon 2002-2012** was important in that it had as its overarching policy thrust the revitalization of agriculture through facilitating the development of an efficient private sector. However, its major theme was improvement in the delivery of government support and services. The strategy aimed at remodeling the legal and organizational structures in the agriculture sector. It drew attention to a range of constraints, including the absence of a National Agricultural Development Plan. Proposed policy interventions focused on the coordination of development interventions and improvements to the provision of credit, cooperative marketing, development funding and extension systems.

Economic argument has been used to justify encouraging 85 percent of the population, who are primary producers, to concentrate on producing those export cash crops for which PNG has a comparative advantage. Unless comparative advantage can be found for currently underutilized species, concentration on a narrow range of exportable tree crops and spices will mitigate against diversification into underutilized crops and domestic food production in general. It is suggested in the strategy that reform of the agriculture sector would prevent such imbalance. The minor crops with immediate potential for export-driven growth are the range of spices and pyrethrum. There is also export potential for staple root crops, especially with downstream processing, for fruit such as pineapples, and for peanuts and tree nuts, such as cashew and Canarium. However, such potential has yet to be realized or will take some time to develop. Justification for a strategic intervention with respect to biodiversity of genetic resources, as given in the Horizon document, is “to research and exploit the genetic and biochemical properties of under-utilized and under-exploited indigenous species for commercialization.”

A crop which is singled out for special mention in the Horizon 2002-2012 document is sago. Sago is the ninth most important food crop in PNG, by weight, and it is the third – coming behind only sweet potato and cassava - for energy production (Bourke and Vlassak 2004). The Horizon document states that: “The available raw material is currently underutilized and offers huge scope for commercial exploitation; particularly to take a share of the local wheat flour market and its potential for cheap starch, alcohol and alternative livestock feed.” A policy to develop and promote an economically viable and efficient sago industry is proposed with a range of research and development strategies.

The PNG Spice Industry Board and DAL produced a **National Spice Development Plan 2003-2007**. The main spice crops - cardamom, chillies, vanilla, nutmeg, pepper, ginger and turmeric - cannot be regarded as underutilized species, although they are not contained in the list in Annex 1 of the International Treaty (ITPGRFA). In the PNG context, they are alternative cash crops to the major tree crops (coconut, coffee, cocoa, oil palm, rubber, tea). Pyrethrum (which is included in this plan) can be considered as underutilized.

While the plan talks about spices in general terms, it focuses on the promotion and development of vanilla, cardamom, chilli, pepper and turmeric, for the medium-term to 2007. There are specific strategies given for each of these crops and for ginger, nutmeg and pyrethrum. NARI is indicated as being responsible for research leading to spice development although in its NSPIP

2006-2010, it only mentions work on pyrethrum, nutmeg, turmeric and pepper. However, an activity that is part of the project entitled 'Evaluation and Commercial Development of Nutmeg, Turmeric and Pepper' is: 'Assess other possible spices such as essential oils'. NARI also maintains the PGR of a wide range of other crops, including several species producing essential oils. Vanilla production in particular is also a major component of NARI's technology dissemination activities.

PNG has no horticultural exports, which is surprising given the superior agronomic conditions existing for the range of fruit and vegetables. The absence of horticultural exports can be explained by three key factors (McGregor et al. 2005):

- A most unfavourable fruit fly status. There are quarantine treatment technologies available to overcome this constraint. However, fruit fly research is focused on the development of management techniques to ameliorate the damage caused to commercial or household fruit crops, rather than on quarantine treatment for exports.
- No apparent comparative advantage in the export of fruit and vegetables.
- A strong comparative advantage in the export of *traditional* tree-crop commodities - cocoa, coffee, palm oil and copra.

Some areas in which to increase marketing efficiency for horticultural products are the following:

- Reducing the involvement of individual farmers in produce marketing.
- Private investment in marketing infrastructure, to reduce produce losses.
- Public investment in roads and telecommunications.
- Encouraging more competition in produce wholesaling.

Indigenous nuts are seen as an exception for value-added horticultural products. Research requirements to support the development of a commercial nut industry include:

- Identification of superior propagation material for cloning.
- Development of a vegetative propagation method.
- Evaluation of planting material for commercial cultivation.
- Development of harvesting and processing techniques.
- General agronomic research.

The value of marketing information has been undermined by:

- The long delay between the collection and distribution of information.
- Insufficient use of radio and newspapers for disseminating information.
- The absence, until recently, of a focused marketing extension programme.
- The absence of information on buying prices for farmers and the cost of marketing.

There is support for a "Buy PNG Fresh Produce" campaign.

Food Security

A detailed analysis of food security strategies for PNG was carried out and documented by Igua (2001). Subsequently, the **National Food Security Policy 2000-2010** (May 2000) was developed as a response to concerns regarding the level of food imports and hence the long-term sustainability of national food security. The assertion was that PNG should take seriously the need to develop and strengthen its capacity to improve the domestic supply of food. Formulation of the plan involved a review of existing food-related policies; development strategies and programmes; projects and activities in food crops and livestock production; fishery- and forest-derived foods; marketing, processing, preservation and utilization. This was intended to complement the 1995 National Nutrition Policy. It gives, as the primary objective, an increase in and diversification of food production in order to achieve greater self-sufficiency and attain food security, both at national and household levels, by 2015. This can be realized through increased agricultural production and income earning from domestic marketing and exports. The policy sets out a range of goals with respect to food production, nutritional status, food quality and safety, downstream processing, marketing, utilization, diversification, access and sustainable use of resources. It also proposes a range of strategies to achieve these goals, including research and extension, education and training, monitoring and collaboration, but is short on specific interventions and there are no clear indications as to who should do what, and where and when to implement the strategies. **Strategies aimed at support for agriculture as a whole** - such as credit schemes, market information and access, reduction of tariffs on inputs, improved access to land, nucleus estate schemes, affirmative action on gender and health issues, maintenance of quality standards and mobilization of local level government, international donor and NGO support programmes - **will benefit producers of underutilized species just as much as those of the dominant crops.**

Food Security is defined as the state of affairs where ‘all people at all times have access to safe and nutritious food in sufficient quality and quantity to maintain a healthy and active life’. It can be argued that most people in PNG are food-secure most of the time and that indicators of insecurity, such as grain imports, are misleading. PNG produces sufficient traditional tuber crops, bananas and sago to satisfy domestic demand but imports the bulk of its rice, wheat, maize and sorghum requirements and considerable quantities of temperate vegetables, fruit, meat and fish products. Substitution of some of these products by local production would benefit foreign exchange balances but increase the cost of living for those people needing to purchase food.

However, there are also vulnerable people, such as those living on atolls or in other difficult environments and there are many pressures on the productivity of traditional agriculture, due to population growth, demands for commercialization of smallholder farming and raised expectations, resulting in declining soil fertility and difficulty in fertility maintenance. Also, there are times of food insecurity during or following natural disasters or climatic events such as drought, frost, landslides or volcanic eruptions. NARI has put considerable effort into addressing some of these problems through documentation and the promotion of an array of drought- and frost-coping strategies (Bang and Sitango 2003, Bang et al. 2003, Kapal et al. 2003), some of which are indigenous strategies. It is also undertaking ongoing research into the assessment of drought-tolerant or early maturing sweet potatoes, the introduction and agronomy of frost tolerant crops, such as wheat, and some new Andean tuber crops (Oca - *Oxalis tuberosa*, Mashua - *Tropaeolum tuberosum*, Ulluco – *Ullucus tuberosus*) for high altitudes, plus the introduction and exchange of crop varieties for atolls, and a range of income-earning opportunities.

Nutrition

The **PNG National Nutrition Policy, March 1995** (which is a revision of the 1978 National Food and Nutrition Policy), states that malnutrition remains a significant problem in many areas and appears to be increasing in others. The main problems emerging are:

1. Protein-energy malnutrition – food availability, access to cash, role of women, custom, knowledge, education.
2. Nutritional anaemia – low dietary iron, malaria, intestinal parasites.
3. Non-communicable diseases – obesity, high blood pressure, heart disease, diabetes and some forms of cancer.
4. Iodine deficiency disorders – primarily a problem of iodine-deficient soils.

In common with many other countries, the problem is two-pronged: (1) Malnutrition, due to inadequate intakes and imbalances which are the result of poverty, population pressures on food crop production, natural disasters, lack of education and gender disparities; and (2) Poor nutrition, due to income inequalities, an urban lifestyle and diet problems.

The goals and general strategies are as would be expected - basically, improvements to diet and intake, monitoring, information and awareness.

Specific strategies aimed at DAL and relevant to this discussion are:

- Improving access to income and services for nutritionally vulnerable communities.
- Improving marketing of locally-produced foodstuffs in major urban centres.
- Supporting the research and development of inexpensive, high quality, nutritious foods.
- Supporting a farming systems approach targeted to disadvantaged areas, and addressing problems of low productivity due to pressures on soil fertility and access to land, improved marketing and downstream handling or processing.

No specific crops are mentioned, but emphasis on promotion and use of local foods implies greater utilization of traditional crops, targeting hotels, restaurants, schools, correctional institutions, hospitals and the national airline, Air Niugini. Traditional staples are not nutrient-dense and are low in protein so there is a need to supplement these with energy-dense, high protein crops. Specific dietary products need to address the needs of high risk groups, such as high protein for children and high iron and protein for pregnant women. Nutritious alternatives to high fat, high salt snack foods should be available but care should be taken since fat may be important for creating energy density. A specific strategy is to increase the use of locally-produced foodstuffs in hospitals and other Department of Health institutions, and also in educational institutions. There is no mention in the policy of specific local traditional green vegetables and legumes. However, publicity material in the form of posters and leaflets prepared by the Department of Health and the promotion of healthy diets give prominent emphasis to the range of local and traditional foods, including traditional green vegetables.

It is important to develop cooperation between agencies dealing with agriculture, health and education, and improve the quality of food and nutrition education in the schools, vocational training centres, village development programmes and the non-formal education sector. Locally-produced foods should be endorsed as 'high quality', thus improving their status. There is a need for information kits and recipes for using local foods. Snack foods can be made from sago, bananas and root crops.

Biodiversity and Conservation

The rich biodiversity of PNG has been the basis for sustenance of life and the economic base for subsistence and for commercialization. Since Independence in 1975, Papua New Guinea's national economic policies have not recognized the sustainable economic benefits possible from utilizing the country's biological resources. Instead, biodiversity has been severely threatened by unsustainable activities aimed at short-term economic gain. Although PNG is party to the Convention on Biological Diversity (CBD), little attempt has been made to date to understand the real values of the existing diversity and its vulnerability. The PNG Country Study on Biological Diversity (Sekhran and Miller 1994), carried out under the auspices of the UNEP-GEF Enabling Activity of the CBD, needs to be updated and revised. PNG's economy is based on agriculture and will remain so for many years to come. Over eighty-five percent of PNG's population lives in rural areas and depends directly on agriculture for livelihood and sustenance. Any major changes to the extent or patterns of agricultural production are likely to come about only if driven by the development of commercialization or trade - whether for export or for domestic markets and substitution for imports: there are many implications of this for agro-biological diversity, the environment and the sustainability of overall development.

The policies and strategies of PNG's **Department of Environment and Conservation** relevant to the utilization of plant species for food and agriculture fall within the responsibilities of the Conservation Division. This Division has three Branches: the Biodiversity Branch, the Wildlife Enforcement Branch and the Parks and Wildlife Branch. The Biodiversity Branch is mainly concerned with documentation and the compilation of inventories of species, as required for specific purposes. The Wildlife Enforcement Branch undertakes activities relating to licensing and law enforcement with respect to aspects of biosafety and the use of biotechnology; and the Parks and Wildlife Branch is responsible for the management of designated national parks, reserves and Wildlife Management Areas. The Department is not generally concerned with the underutilized species as defined for this analysis, with the exception of the forest species which might be at risk or fall within its responsibilities for the management of protected areas. Staff of the Department does, however, have an interest in the wild relatives of domesticated species or species with possible alternative uses. Recent activities undertaken by NARI staff have involved collaboration with scientists of the National Institute of Agrobiological Sciences, Japan, in the collection of wild *Vigna* and *Oryza* species in specific areas of PNG.

The Department of Environment and Conservation also hosts the secretariat of the PNG Institute of Biodiversity (PINBio), alternatively known as the PNG Biodiversity Network (PNGBioNET). This is a flexible network of public, private and non-governmental organizations, established to support biodiversity conservation and explore alternative options for economic development through research and development programmes. The main issues which PINBio is tasked to address include threats from unsustainable or detrimental human activities and the development of appropriate policies with respect to biological discovery and consequent economic development of new natural products for agriculture, health and other industries. Through the setting up of PINBio, the Government of PNG is committed to the establishment and development of conservation and biodiversity-based industries, and support to research and development towards these ends. The activities of the PINBio partners fall within nine programme areas, each of which is the responsibility of a Lead Institution, with a range of other participating institutions or organizations.

The nine programmes are:

1. Biodiversity inventory – surveys, collection, documentation, indigenous knowledge
2. Biodiscovery – drugs, medicines, toxins, venoms, aromatics
3. Agro-biodiversity – Plant Genetic Resources for Food and Agriculture (PGRFA), agro-chemical development
4. Biotechnology – including biosafety measures
5. Biodiversity conservation through carbon-offsets and trade initiatives – protected areas, reforestation, sustainable logging, agroforestry, biomass energy
6. Biodiversity database and management system – effective and efficient information sharing
7. Policy and legislation – access and benefit sharing, Intellectual Property Rights
8. Training and infrastructure development – capacity building and strengthening
9. Education and awareness – public education and awareness of benefits of biodiversity

Plant Genetic Resources (PGR) Activities

One of the functions of the **National Agricultural Research Institute (NARI) Act 1996** is ‘to maintain and conserve the diversity of genetic resources for food and agriculture, act as custodian for these resources, and promote the effective utilization of these resources in the country’.

NARI has produced a ‘**Plant Genetic Resources Strategy for Papua New Guinea**’ (Kambuou 2005). The general objectives of this strategy reflect FAO’s Global Plan of Action on the Conservation and Sustainable Utilisation of PGR for Food and Agriculture and the objectives of the Convention on Biological Diversity. There are no specific or distinct strategies in this document concerning the species listed earlier, except that aibika gets special mention because of its local importance as the major staple green vegetable. NARI currently maintains 118 accessions of aibika, 15 species of fruits and nuts and 12 accessions of seven species of minor leafy vegetables, as well as its extensive and valuable collections of cultivars of sweet potato, cassava, banana, taros and yams. NARI will shortly undertake work on the characterization and further evaluation of lowland pitpit (*Saccharum edule*).

There is much current interest in the Pacific in characterization and evaluation of the genetic resources of breadfruit. Regional organizations such as the Secretariat of the Pacific Community, through its Plant Genetic Resources adviser and Regional Germplasm Centre in Suva, are particularly active in promoting and assisting PGR work on a Pacific-wide collaborative basis. Another current interest being pursued by workers in Pohnpei State of the Federated States of Micronesia concerns carotenoids in bananas and other Pacific crops (Englberger and Lorens, 2004). PNG has a number of such varieties among its banana, taro and sweet potato collections, and these need to be investigated with respect to potential roles in combating vitamin A deficiencies, anaemia, diabetes, heart disease and possibly certain cancers.

The Department of Agriculture and Livestock produced a draft ‘**Papua New Guinea National Plant Genetic Resources Policy**’ which is un-dated but was written in 2003. In most respects, it is similar to the NARI Strategy but it does mention plants with utility in forestry as well as traditional medicine and floriculture (especially orchids). The role of the Department of Environment and Conservation is acknowledged. However, there are no affirmative action policies for utilization of the diversity of underutilized species.

Submissions are being made to the NEC and thence the national parliament for GOPNG, to accede to and ratify the International Treaty (ITPGRFA). Under this treaty, the GOPNG will be obliged to – ‘develop and maintain appropriate policy and legal measures that promote the sustainable use of plant genetic resources for food and agriculture’, as well as the other obligations specified in the treaty. In the PNG context, this means paying particular attention to the conservation and utilization of the diversity of plant genetic resources with which this country is so richly endowed.

PNG’s diverse climatic conditions mean that there is an astonishing range of available fruit and nuts, as well as prolonged seasonal availability. Surprisingly, however, very few of these are grown commercially. A considerable quantity of fruit is imported, including significant quantities of citrus and even pineapples. Most tropical tree fruit is produced by villagers from unselected trees. Some of the fruit reaches local markets but the quality is poor. Clearly, there is great potential for the production of an improved variety of fruit, both for household food security and for commercial industry development. Increased production of improved quality fruit, however, does not guarantee export. Domestic markets are undersupplied. Much of the new fruit will not even enter formal markets but be consumed by rural households, resulting in improved nutrition and food security. There is also a wide range of green leafy vegetables grown throughout PNG, with the most common being Aibika (*Abelmoschus manihot*). These vegetables are highly perishable and are sold close to the production point.

A private sector entity has recently approached both NARI and the PNG Investment Promotion Authority (IPA) for assistance in promoting and exporting sauce and oil made from the fruit of Marata (Marita) (*Pandanus conoideus*) which is commonly used in traditional cooking. The IPA has a 50:50 Feasibility Study Grant Scheme for investigating enterprises with such potential. Relevant technical assistance both in agronomy and quality control can be given by NARI on a contract basis.

NARI Research Papua New Guinea’s National Agricultural Research Institute (NARI) has the mandate to undertake research on food crops and on minor or emerging cash crops, with particular emphasis on assistance to smallholder farmers. Its mission is therefore to promote innovative agricultural development in PNG through scientific research, knowledge creation and information exchange in pursuit of its vision of prosperous PNG agricultural communities. PNG has a rich biodiversity which includes a wide range of Neglected and Underutilized Species of plants for food and agriculture, both planted and gathered from the wild. Some of the latter are suitable for domestication and this is the focus of NARI’s current research on *Canarium* nuts. NARI’s current research portfolio includes work on the genetic resources, breeding, and pests and diseases of the major staples – sweet potato, Colocasia taro, banana and several species of yam – as well as on rice, open pollinated maize, peanuts and, for the hitherto-neglected high altitude highlands above 1800m, potato and wheat. There is continuing emphasis on crops or varieties suitable for neglected or difficult environments, such as those with declining soil fertility, those prone to drought or frost, and atolls, either as emerging economic crops such as pyrethrum or with identified capacity to cope with adversity. New work is focusing on a wide range of grain legumes such as cowpeas, mungbeans, pigeon peas, chickpeas, winged beans and lupins, as well as soybeans.

Research projects proposed in the NARI Strategic Programme Implementation Plan (NARI 2006) for the next five years include those on post harvest technology and downstream processing to expand demand, as well as marketing studies (especially for staples), and work on sago, two species of pandanus and several indigenous nut and fruit species. An active Plant Genetic

Resources Programme will continue, dealing with the conservation, characterization, evaluation and utilization of the diversity within the main staples and traditional vegetable crops such as aibika and the two species of pitpit.

NARI has produced the afore-mentioned **Strategic Programme Implementation Plan 2006-10**. This plan has a well-designed programme on conservation, management and utilization of plant genetic resources, with a special focus on crop species indigenous to PNG. The genetic resources programme strategy is the rationalization, enhancement and maintenance of plant and animal germplasm collections for efficient utilization. The plan includes activities on the identification of genetic diversity of food crop species, including the underutilized species, conserved and utilized by farmers under *in situ* or on-farm conditions. Also included are research and development programmes in crop improvement and post-harvest research, which look to improving the potential and value addition of such underutilized crop species. Focus crops are sweet potato, yams, Colocasia taro and cassava.

Also included in NARI's research agenda is a project on the Evaluation and Integration of Legume Crops into Farming Systems. This includes rescue of the lost collection of indigenous winged bean varieties and their re-evaluation. NARI is about to embark on a major research and development project in the downstream processing of sweet potato. An important objective is to create increased demand for this crop and thus enable smallholder farmers to take advantage of available technologies to increase productivity and, consequently, production.

Forestry

Nearly eighty percent of PNG's total landmass of 46 million ha is forested. Closed canopy forest covers 33 million ha, of which 15 million ha are considered accessible for commercial utilization. They are considered to be renewable natural assets, and **the cornerstone of forest policy** - as stated in the **National Forest Policy 1991 - is to ensure that forest resources are used and replenished for the collective benefit of the people, now and for future generations**. The emphasis is on sustainable use. Most of this forest is under customary ownership and has been used for tens of thousands of years to supply food, medicines and materials for building, household utensils, clothing, transport, tools, weapons, art, and for ritual and personal ornamentation. All of the latter is reasonably well documented (Powell 1976). Sustained yield management and reforestation are key elements of forest policy, with promotion of afforestation programmes for non-forested and severely deforested land. The policy also allows for the setting aside of land of ecological importance, as conservation areas. There is a brief section among the forest industry strategies referring to small-scale forest-based industries such as portable sawmilling, handicraft and artifact making, furniture making, rattan cane and sandalwood harvesting. The PNG Forest Research Institute is delegated to pursue research into the cultivation, management and utilization of minor forest products with the objective of increasing rural incomes. However, this activity has been accorded low priority by the Institute.

In recognition of these deficiencies and the lack of capacity to permit the successful implementation of the 1991 policy, the PNG Forest Authority which is the statutory corporation with regulatory and administrative responsibility for national forest management, produced a draft **National Eco-forestry Policy** in June 2003. Eco-forestry refers to the management of natural forest resources by the people and for the people. It is centered on the rights, duties and livelihoods of people and future generations, and collaborative management is at the core of the eco-forestry approach. The new draft policy states that lack of policy on non-timber forest

products (NTFPs) is a matter for concern and that allowing the collection of products such as food and medicines is a basic principle for management.

Communities located in remote forest areas utilize and make a living from a broad range of NTFPs (non-timber does not mean non-wood but excludes sawn timber), many of which provide income opportunities for women or disadvantaged communities. A few NTFPs are not confined to use at the local level only and two in particular are highly valuable. These are sandalwood and eaglewood, both of which offer outstanding commercial opportunities but are being seriously depleted. Sandalwood is the vernacular name for *Santalum macgregorii*, a tree species found in the Central, Gulf and Western Provinces, and the National Capital District, from sea level up to 800m altitude. Eaglewood is a wood defect that is found in the trunk and branches of *Gyrinops ledermannii* in PNG and has been traded and used as a fragrant material in aromatic, medicinal and religious preparations for centuries.

Eaglewood is a very valuable commodity, both on Asian and middle east markets and it has a positive impact on poverty alleviation through income generation in remote areas. Due to a very high value-to-weight ratio, it is particularly convenient where there are no roads. The same comment applies to sandalwood.

All policies and strategies proposed for eco-forestry would have a positive impact on biodiversity conservation and hence on the availability of underutilized species for future on-going, low level use or sustainable exploitation. Strategies include forest and biodiversity inventories, small- and medium-scale sawmills, specified conservation areas and eco-tourism. Specific proposed policy is for the promotion of sustainable utilization, management, processing and trade of NTFP, including wood for local construction, implements, utensils and firewood; orchids; fruits for food; fruits, leaves, barks, exudes, flowers and roots for traditional uses, medicine, clothing, decoration, dyes or poisons; mushrooms; rattan. There is a set of positive policies with respect to eaglewood and similar policies are to be formulated for sandalwood.

It remains to be seen whether the very positive policies and strategies proposed in the draft National Eco-forestry Policy document can be put into effect. Access to forest resources is regulated by the principles of community ownership and rights which differ from culture to culture but generally allow unregulated access by members of the community. Restrictions may apply where areas are leased to logging companies under concession agreements, or when areas are designated as parks, reserves or Wildlife Management Areas under the custodianship or oversight of the Department of Environment and Conservation. In general, restrictions in such areas are concentrated on the control of hunting rather than on the control of the harvesting of NTFPs. The likely development outcomes are increased resource productivity, increased high quality food production, more efficient utilization of domestic resources and the effective conservation of biodiversity for cultural values as well as future economic use.

Woodlots are defined as any reforestation or afforestation areas of less than 1000 ha. The policy includes growing of eaglewood, sandalwood and balsa. Balsa grows particularly well in certain defined areas of PNG and is an important industry, particularly in the East New Britain province. It is a very valuable product with a good market when grown to high quality standards. Domestication of indigenous tree species, to enable them to be cloned and grown in woodlots or plantations, is currently the subject of research and development by the Forest Research Institute, the National Forest Service and NARI.

Indigenous nuts, with a high protein content, are a significant seasonal component of people's diet throughout the country. Of a total of around fifty kinds of nuts that are collected and eaten in PNG, Galip (*Canarium spp.*), Pau (*Barringtonia spp.*) and Okari (*Terminalia kaernbachii*) are very common in the lowlands and Karuka nut (*Pandanus julianettii*) is important in the highlands. Of these, galip is by far the most important in terms of volume consumed and, hence, as a protein contribution to people's diet in the lowlands.

The NARI Strategic Programme Implementation Plan 2006-2010 includes an on-going project on the domestication and commercialization of indigenous nuts and fruits. Activities to date have focused on galip nut (*Canarium*) with considerable success and will later be extended to include okari and taun. Expected outputs from this work will be small-sized, uniform, high-yielding trees suitable for commercial and household cultivation, together with recommended post harvest and processing techniques, information on economic feasibility and technology packages for growers.

The existing forestry plantation is based on a limited number of species within the genera *Acacia*, *Araucaria* and *Eucalyptus*. There is considerable capacity for broadening the scope through domestication of other suitable species. Current domestication work is focused on *Endospermum medullosum*.

Another project of relevance concerns the development of a sustainable, community-based essential oil industry in the Western province, using the region's woody plant species. These essential oils are similar to eucalyptus oils and have a ready local market. The principal oil-producing species is *Asteromyrtus symphyocarpa*, known locally as waria waria.

Education

Primary education. The primary school system is in the process of implementing a new component for Grades 6, 7 and 8 which is documented in the brochure **Making a Living – Upper Primary Syllabus 2003**. This integrates relevant practical skills and knowledge of agriculture, basic technology and commerce, fostering integral human development and the development of practical skills and knowledge to contribute to the local community.

The syllabus has a clear focus on social and environmental sustainability, the development of an appreciation of the diversity of natural environments and cultures and a sense of the importance of the need to protect and conserve them. It aims primarily at promoting an understanding and appreciation of a wide range of indigenous and introduced ideas for managing resources, healthy living and community development; development of safe techniques to use locally-available resources sustainably, to improve the quality of life; appreciation of the diversity and uniqueness of PNG's environment, and management of same in a sustainable manner.

The contents include:

- The principles and techniques of using land to increase the quality and quantity of food production for own consumption or sale;
- how to prepare nutritious food;
- an understanding of the nutritional value of crops and comparison of the benefits of traditional and commercial crops; and
- analysis of aspects of a nutritious diet and suggestions as to how and where people might obtain, preserve, process and prepare these foods to meet nutritional requirements.

Learning outcomes with indicators include the ability to:

- identify which crops are best suited to local environments;
- choose and apply the most appropriate gardening practices;
- identify benefits associated with traditional and commercial crops;
- identify local environmental conditions that would influence the choice of crops;
- discuss the importance of food security in achieving sustainable livelihoods;
- Describe what a nutritional diet consists of and compare with current diet;
- identify positive and negative aspects of own diet;
- make suggestions as to how to improve the diet;
- identify local food sources; and
- identify a range of traditional and modern methods of food preparation.

This is all very positive but it does depend on the choice made by the teachers concerning the crops used as examples and for demonstration.

Secondary education The secondary school system is also undergoing a process of change and curriculum development to give emphasis to agriculture as the mainstay of the PNG economy and only feasible source of future prosperity. From 2008, agriculture will be a compulsory core subject in the lower secondary school syllabus (Grades 9 and 10 in a 12 Grade/Year system) and is documented in the publication **Agriculture: Lower Secondary Syllabus** (Department of Education 2006). The syllabus builds on concepts, skills and attitudes from the Upper Primary level and prepares students who wish to continue with agriculture as an option in the final two years of Upper Secondary school. However, it also has an end in itself – that of preparing students who complete their education at this level to be able to lead productive lives in the rural communities from which most of them come. Hence, there is emphasis on understanding the importance of sustainable land and farm management practices and the wise use of new agricultural technologies.

Students practice the development and management of agricultural enterprises through undertaking practical projects. These projects take up 50 percent of the time available, which is five periods per week over the two year programme. They allow for the development of skills that are simple, practical and appropriate to the local situation and opportunities. Study will cover both traditional and modern, or emerging, agricultural enterprise and therefore has much scope for the inclusion of options for the use of underutilized species. The syllabus embraces traditional concepts and integrates those that are appropriate into activities that are productive and sustainable. Teachers should take a balanced approach in which traditionally-valued crops are grown along with introduced ones, using appropriate technology. People from the community can be involved in activities to help teach skills and impart both traditional and contemporary knowledge. There is considerable leeway for teachers to be flexible in the development of student projects and scope for teachers or students to choose projects relevant to the use of underutilized species.

Agriculture is currently taught in three universities in PNG, as well as in a number of vocational education institutions. The University of Goroka differs from the PNG University of Technology and the University of Vudal (now re-named the PNG University of Natural Resources and Environment) in that it offers a Diploma in Agricultural Education and a Post-graduate Diploma in Education with agriculture as a teaching subject, both requiring a prior agriculture diploma or degree qualifications. The content of these Diplomas is geared to the requirements of the evolving

primary and secondary school curricula. However, the comments that follow apply in all of these tertiary level institutions.

Ample scope in university systems for projects/ research on currently neglected species

All curricula allow for approximately equal emphasis to be given to short-term crops, including the major food staples, and the major perennial crops which dominate agricultural export. There are no specific courses geared to consideration of the wide range of underutilized species with potential; in fact, even the underutilized potential of the major food staple crops for downstream processing and marketing is not given any emphasis. There is ample scope in the university systems for student and academic staff projects and research on currently neglected species, such as recent research in the University of Technology on noni. Much research was carried out in the 1970s by the University of Papua New Guinea on winged beans but there was no subsequent follow-up for further utilization of this indigenous crop. The science and medical faculties of this university have also on-going interest in traditional medicinal plants and their products. Current interest at Vudal is in some minor food crops, such as lowland pitpit (*Saccharum edule*) and Xanthosoma taro.

Need for greater information on underutilized or traditional species crops

An important point made by University staff during the Vudal Workshop was the need to have both biological and economic information on a crop. Currently underutilized crops could be given more emphasis in relevant syllabi. Teaching is biased towards crops such as rice and introduced vegetables because there is more or better information available on these crops; however, this creates a bias against underutilized or traditional species. It appears that important opportunities are being missed to create awareness of the potentials of underutilized species amongst the students of tertiary institutions who will be leading agricultural development into the future.

Finance and credit

The **Investment Promotion Authority** (IPA) is a statutory organization, established by an Act of Parliament in 1992 to promote and facilitate investment in the PNG economy. It has the power to regulate foreign investment in particular and to monitor the impact of investments and the activities of enterprises. Its Feasibility Study Grant Scheme has been mentioned earlier in this report (page?). IPA responded to the questionnaire and also participated in one of the workshops for this project. During the workshop, the representative made the point that IPA has a reserved activities list for cottage-industry-type business activities that can be used if necessary to ensure exclusive PNG-citizen access to new enterprises utilizing natural resources. The authority should be able to provide market information for possible new investors in activities involving underutilized species. However, perhaps of more relevance in this regard is the **Small Business Development Corporation**, a statutory authority under the Department of Trade and Industry, which has the aim of promoting small and medium enterprise so as to enable citizens to be self reliant and contribute to national development. The types of activities encouraged by the corporation include honey production, soap manufacturing, and the processing and marketing of spices such as turmeric, cardamom, ginger, lemon grass and chili.

RDB's aim to provide finance for agricultural ventures

Provision of micro-credit, or rural credit in general, remains a problem although there have been some initiatives in this area. It is extremely difficult, if not impossible, for smallholder farmers using land in traditional, customary or communal ownership, to obtain credit from a bank or other credit providers. The **Rural Development Bank (RDB)** was set up to finance farming ventures but was unable to remain viable, due at least in part to an over-estimation of profitability and of farmers' commercial skills, and hence loan repayment. The bank has now been restructured and refinanced to operate as a commercial trading bank, but retaining micro-finance facilities and products and the specific responsibility to finance agricultural ventures. RDB representatives at two of the workshops pointed out that the problem lies in determining the viability of the venture to service the loan. With surety on this issue, the bank can be flexible and should be able to play a major role in rural development. **The production of underutilized species can be a niche market for the bank but there is an onus on research institutions to provide the necessary information, so as to facilitate decision-making as to viability of enterprises.**

The RDB can readily provide finance up to PNG Kina 10,000 if viability can be assured. There are also other micro-finance institutions such as PNG Micro-finance run by PNG Sustainable Development Ltd (mining money) and Wau Micro-finance which was set up as a model through an ADB-financed project. **The key to successful micro-finance is accurate production and economic information.** Another alternative, however, which is becoming accessible and increasingly available in many parts of the country, is the provision of District Treasuries with associated banking through one of the major trading banks, thus making banking more accessible. This enables farmers, once they have been able to start production on a small-scale commercial basis, to save capital securely as start-up capital for the next crop. Training of farmers in budgeting and managing finance is now a repeated request on the part of the farming community. This represents a challenge for NGOs and other training and extension providers.

III: RESPONSES TO THE QUESTIONNAIRE

A simple questionnaire was developed and sent to a wide range of likely respondents, to obtain information on institutional or organizational attitudes towards underutilized species. This questionnaire was delivered by e-mail, facsimile or hand to a total of 46 potential respondents, including provincial agricultural advisers, educational institutions, non-government organizations, statutory bodies and private-sector companies. The complete document is attached as **Appendix 1** and the actual questions asked were as follows:

- 1. Does your organization have any policies, strategies or activities which promote or support the utilization of currently underutilized species as defined?**
- 2. Does your organization have any policies, strategies or activities which prevent or impede the utilization of underutilized species?**
- 3. Could or should your organization do more to promote or support the further utilization of these underutilized species?**
- 4. Could or should PNG in general do more to promote or support the further utilization of these underutilized species?**

5. If your answers to questions 3 or 4 are yes, please suggest any policies, strategies or actions that might be undertaken, where and by whom?

There were 14 responses, as indicated in **Appendix 2**.

Very few specific institutional policies, strategies or activities were identified. Suggested strategies related mainly to the National Food Security Policy or to improved nutrition. There was mention of the need to integrate a wider range of crops for diversified development and to profile or promote those deemed suitable for local or export niche markets. One activity highlighted is the development of large-scale cassava planting for ethanol production, which is the subject of current investment negotiations.

Respondents did not identify any impeding policies except for the existing strategy of giving priority, in general, to improving existing systems for food security and incomes. However, one interesting comment was that policies for the conservation of rarer species may impede utilization unless this is linked to increasing plant populations or wider geographic distribution.

Some organizations suggested that the promotion of underutilized species is outside their mandate or that further utilization will take place only if new crops are seen to have a clearly-defined market and economic returns that are better than those for existing market crops. However, most organizations felt that they could do more but were limited by lack of knowledge or inadequate funding. There is a need for better information on overseas marketing and on procedures to meet health and quarantine requirements. Institutions could work better with local communities, to understand and support *in situ* conservation of genetic diversity, identify local market opportunities, and promote diversity for coping with drought and other natural disasters, sustainability of traditional systems and food security.

The concept of community Diversity Fairs which would showcase genetic diversity and underutilized species was raised for possible institutional initiatives or for incorporation into existing open days, shows or other public events.

Respondents were more definite in suggesting national support for the promotion of underutilized species. **It was stated that sustainable agricultural development is not taken seriously by governments - provincial or national** - the assumption being that people will continue to look after their food needs and that economic development comes from large-scale investment projects. Little consideration has been given to investigating new crops that have market potential, downstream processing of food crops, niche markets or organic certification. **There is strong belief that the biodiversity of PNG has much to offer the world in terms of plants that have considerable food or medicinal potential.** There is also an urgent need to identify traditional food crops, indigenous nuts, fruits and vegetables, ornamentals and herbs that would warrant research and development. Some underutilized species with potential are found in intact forests and should be able to bring realizable benefits to local communities.

A large number of ideas were forthcoming as to what actions might be undertaken. Most of these have already been mentioned but are listed again below for emphasis and ease of reference:

- Promotion of proper nutrition through the school system.
- Identification of potential cash crops, e.g. indigenous nuts marketed as organic gourmet products.

- Investigation into Organic Certification.
- Promotion of Crop Diversity Displays or Fairs.
- Economic assessment of each crop with potential for investment.
- Consideration of issues related to Intellectual Property Rights and Traditional Knowledge.
- Incorporation of information on underutilized species into development planning.
- Publication of information on species that have potential.
- Rationalization of decision making with respect to *in situ* or *ex situ* conservation of crop diversity.
- Research into commercialization potential and downstream processing.
- Assessment of earlier research findings or available information on usage and advantages of traditional crops.
- Investigation into the production of NTFP or the sustainable production of forest products such as rattan for livelihoods in remoter areas.

What is required is a crop-by-crop multi-disciplinary approach to the development and regulation of new food crop industries aimed at export markets. A moot point was made that there has been no food crop industry development in PNG, in spite of decades of research and it is necessary to try to understand why this is so.

IV: OUTCOME OF THE WORKSHOPS

The original intent of the workshop(s) was to assess and, presumably, endorse the results of the analyses of policies and strategies, as documented. In the event, and at least partly due to the paucity of relevant documentation and the poor response to the questionnaire, it was decided to have four smaller, one-day regional workshops, in order to obtain the views of a cross-section of stakeholders not adequately represented earlier and have the prospects of some unique perceptions. This included better representation from financial institutions (IPA and RDB), secondary school teachers of agriculture and university staff. The list of participants attending these one-day regional workshops is provided in **Appendix 2**. Participants worked in small groups to answer three basic questions and were then invited to add any comments on their own possible institutional response. The questions were:

1. *Why should we be concerned about underutilized species?*
2. *What are the constraints to increased use?*
3. *What can be done about it, or what next?*

The valuable attributes or roles of underutilized species are easy to define. Those provided in the responses were nutritional and medicinal values; food security, including hardiness or resistance to pests, diseases, drought or frost; commercial potentials especially the value in local and export niche markets and with improved handling, adding value and processing; traditional and social

values and definition of cultural identity; maintenance of dietary diversity in response to the impoverishment of diets based on rice and tinned fish; and diversity of plant life, ecosystems and landscapes, seen as values in their own right, particularly in the face of indiscriminate logging. Many crops are high in value for weight or volume and hence are particularly useful for producers with poor market access. PNG has international stewardship obligations for much PGRFA and many vulnerable species.

Constraints to utilization centre mainly on lack of information and knowledge, especially with respect to market value and nutritional value. Many crops are known and valued locally but the socio-geography of PNG is such that this knowledge is not available nationally and may not even be shared willingly. There may be local restrictions or taboos regarding use. Many crops are perishable in nature, production may be seasonal and there is a lack of preservation or processing technologies. However, such technologies may be labour-intensive or time-consuming. Plants may be delicate or susceptible to pests and disease, especially if commercialized or taken outside of their native habitat. Domestication may not be easy. In general, research and development, promotion and marketing, awareness and policy support are all inadequate. Official government policies, such as the promotion of rice production, ostensibly for import substitution, may have negative consequences on traditional food production. Support and infrastructure for product development are weak in PNG and the domestic market is not large enough to support major private-sector investment. Private sector involvement is tentative at present, and pursues 'sure-bet' options only, such as fruit jams and wine. Apart from work on downstream handling and processing technologies, specific areas for research intervention include cracking of indigenous nuts, vertebrate pest management, seed selection and maintenance of seed quality, and the definition of nutritional values.

Urgent need for greater information and sharing of traditional knowledge

Information dissemination and the sharing of traditional knowledge are crucial. **There is need for an annotated bibliography on the traditional uses of the various species and traditional processing technologies.** The key to utilization beyond the local level is market demand and the creation of enabling environments for market development. Producers will follow demand from consumers. At least an initial assessment of crops with potential must be made and incorporated into the upcoming National Agricultural Development Plan. **Such underutilized crops should not be thought of as substitutes for currently popular crops but as new opportunities in their own right.** There is a need to identify information gaps, specific constraints and appropriate implementation agencies. Who is responsible? **It is clear that political awareness and therefore support will come if crops can be shown to have the capacity to contribute to national development and poverty alleviation.** This report, too, may have an influence if circulated to relevant policy makers and planners.

V: ELEMENTS OF A STRATEGIC PLAN

The following suggestions have arisen out of the analyses or have been proposed by workshop or questionnaire participants. They form the core of a strategic plan of action for strengthening policies and programmes designed to make a more effective use of the range of underutilized species of plants or crops for food and agriculture.

- PNG staple food crops must be regarded as underutilized with respect to commercialization, export potential and downstream processing.

- Such crops are currently the primary source of income for many smallholder farmers and this must remain a primary focus for rural development.
- Utilization must contribute to national goals of broad-based economic growth and poverty alleviation through smallholder agriculture, export promotion and private sector initiatives.
- Research into the production of traditional crops must remain a priority.
- National agricultural development plans must adequately recognize the potential roles of currently underutilized species.
- There must be strategic interventions to conserve yet exploit the genetic potentials and biochemical properties of the rich biodiversity of underutilized plants.
- An industry with major potential is that of bio-fuel production from crops such as cassava, sago and coconut.
- Adequate resources must be given to research and development for the spice industry, including essential oils, and to exploit the export potentials in horticulture, including floriculture.
- Food security policies and strategies must give primary attention to food diversity and nutritional quality, as well as income-earning potentials from underutilized species.
- Strategies for improved nutrition must address the major problems of protein-energy malnutrition, nutritional anaemia, nutrition-related diseases and iodine deficiency disorders, and improve access to traditional foods in urban and environmentally disadvantaged areas.
- Local foods must be promoted in the Tourism industry, in schools, correctional institutions and hospitals.
- Publicity and awareness, research and development to increase the utilization of highly nutritious, locally-produced food crops must be stepped-up and on-going.
- Activities falling within the programmes of the PNG Institute of Biodiversity network need to be adequately supported for biodiversity conservation and the sustainable exploitation of such biodiversity.
- Plant genetic resources strategies must include affirmative action for the utilization of crop germplasm diversity conserved both *ex situ* and *in situ*.
- There must be positive affirmation and action to ensure that the forest resources can continue to be used and replenished for the collective benefit of traditional landowners.
- Research and development strategies must focus on small-scale forest-based industries and non-timber forest products, as well as on alternative income-earning opportunities to enable traditional forest users to protect the biodiversity.
- Implementation of the new Upper Primary syllabus 'Making a Living' and the new core agriculture syllabus for Lower Secondary schooling must be supported by adequate teacher training and strong encouragement to consider underutilized species for project work.
- The bias against traditional or underutilized crops in higher education teaching due to paucity of biological and economic information must be addressed through research and documentation.
- Efforts to facilitate the provision of micro-credit to smallholder farmers must be supported through the generation and availability of accurate crop production and economic information.
- The training of farmers in budgeting and financial management is a must.
- There needs to be investigation into the best ways of obtaining organic certification and hence promoting PNG crop products in gourmet or niche markets.
- Strategies must promote the dissemination of information on underutilized species and the sharing of traditional knowledge.

- Documentation of existing knowledge is essential.
- Public and political awareness of the valuable attributes and potentials of traditional and currently underutilized crop species are crucial, both for conservation of biodiversity and economic development through sustainable exploitation of this resource.

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APPENDICES

Appendix 1: The Questionnaire

Appendix 2: Persons consulted

THE QUESTIONNAIRE

The National Agricultural Research Institute (NARI), in collaboration with several other agencies, has been contracted by the Global Facilitation Unit for Underutilized Species (GFU), International Plant Genetic Resources Institute, to undertake an analysis of national and institutional policies in Papua New Guinea that directly or indirectly affect the use of currently underutilized species of crop plants for food and agriculture.

The purpose is to explore various issues and develop mutual support in efforts to ensure that designated underutilized crop species form an intrinsic part of national agricultural development policies, strategies and plans for the benefit of smallholder farmers and the nation. The current task is to examine existing policies, legal instruments and strategies, or the absence of same, that affect, positively or negatively, the improvement and utilization of the real potential of underutilized crops in PNG.

The objective is to produce a fully documented, analyzed and justified strategic plan for strengthening the national and key institutional policy and legal frameworks to enable effective conservation and sustainable use of currently underutilized crop species for food and agriculture.

In the PNG context, we are assuming that underutilized species of food crops are those that are used but are not major staples. The major crops concerned include:

All traditional green vegetables including Aibika (*Abelmoschus manihot*), Tulip (*Gnetum gnemon*), Aupa (*Amaranthus*), Rungia (*Rungia klossii*) and Water Dropwort (*Oenanthe javanica*)

The two Pitpits (*Sacharum edule* and *Setaria palmifolia*)

Pandanus – Marita (*Pandanus conoideus*) and Karuka (*P. julianetti*)

Winged Bean (*Psophocarpus tetragonolobus*)

Choko (*Sechium edule*)

Indigenous nuts and fruits including Galip (*Canarium polyphyllum*), Okari (*Terminalia kaernbachii*), Pau (*Barringtonia procera*), Aila (*Inocarpus fagiferus*) and Taun (*Pometia pinnata*)

However, it is possible to include also the PNG staple crops which are not fully utilized to the extent of commercialization, export potential, downstream processing or added value and alternative uses. Such crops are sweet potato, taro (*Colocasia* and *Xanthosoma*), *Dioscorea* species of yams and bananas, sago and cassava as well as coconut as a food crop.

Non-food crops of interest can include:

Noni (*Morinda citrifolia*)

Tapa (*Broussonetia*)

Abaca (*Musa textiles*)

Rattans (*Calamus spp.*)

Vetiver (*Vetiveria zizainoides*)

Japanese Mint (*Mentha arvensis*)

Lemon Grass (*Cymbopogon citrates*)

Sandalwood (*Santalum macgregorii*)

Essential Oils (*Asteromyrtus symphyocarpa*)

Your assistance is being sought to aid us in this work by answering the five questions set out below in this questionnaire.

- 1 Does your organization have any policies, strategies or activities which promote or support the utilization of currently underutilized species as defined?**

- 2. Does your organization have any policies, strategies or activities which prevent or impede the utilization of underutilized species?**

- 3. Could or should your organization do more to promote or support the further utilization of these underutilized species?**

- 4. Could or should PNG in general do more to promote or support the further utilization of these underutilized species?**

- 5. If your answers to questions 3 or 4 are yes, please suggest any policies, strategies or actions that might be undertaken, where and by whom?**

Please return the completed questionnaire by 24th February 2006 to:

Dr Alan R. Quartermain
National Agricultural Research Institute
P.O. Box 4415
Lae.

Thank you.

PERSONS CONSULTED

Respondents to Questionnaire (14)

Tom Okpul – PNG Unitech
Miriam Supuma – Wildlife Conservation Society
Ungia Kembo – Southern Highlands DPI
Leki Romulars – Milne Bay DAL
Jimmy Saoia – Milne Bay Conservation International
Geoving Bilong – Morobe DAL
John Arabata – Oro DAL
Robert Lutulele – FPDA
Eric Mallen – North Fly DAL
Clarence Hoot – IPA
Rosa Kambuou – NARI
Ronnie Tirone – Enga DAL
Mark Hadfield – CLTC
Bill Simpson – SIL

Lae (NARI) Workshop Participants (10)

Geoving Bilong – Morobe DAL
Philip Yendowe – RDB
Eki Ronuc – RDB
Elick Guaf – NARI
Friel Biwa – Malahang Technical High School
Besi Simongi – Bugandi Secondary School
Samba Lames – Busu Secondary School
Yomsaung Kiki – Bumayong Lutheran Secondary School
Nalish Sam – PNG FRI
Norah Omot – NARI

Vudal (East New Britain) Workshop Participants (12)

Ann Chan – Vudal
Isako Esekia – Sonoma Adventist College
Nathaniel Philip – Sonoma Adventist College
Gitala Pranis – Vudal
Joachim Pitala – Vudal
Jennie Waira – Vudal
Graham Potal – East New Britain DPI
Shirley Poka – Vudal
Andrew Judah – Vudal
Bill Bakau – Vudal
Annette Mwayawa – Vudal
Naomi Mwayawa – Vudal

Port Moresby (Laloki) Workshop Participants (10)

Kini Mala – IPA
Jo Tumbemangi – Social Research Institute
Conrad Retevire – RDB
Peter Corbett – NARI
Veronica Mangi – NARI
Rosa Kambuou – NARI
Janet Paofa – NARI
Jacqui Wright – ACIAR
John Demarua – NARI
James Ernest – NARI

Goroka Workshop Participants (9)

Igu Yawane – Eastern Highlands Province DAL
Ernest Natera – FPDA
Merolyn Fifine – Goroka Secondary School
George Nomino – NDAL Highlands Region
Osi Yopahafo – FPDA
Sonnie Hizetille – FPDA
Robert Lutulele – FPDA
James Watson – New Guinea Fruit Company Ltd
Silas Wagi – Kabiufa Adventist Secondary School

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Tevo Tarepe
Passingham Igua
Charles Maika
Gordon Wallangas
Alois Ndrewou
Wayne Powae

Port Moresby

Jennifer Sangga - Education Department – Curriculum Unit
Wendy Gilson – Curriculum Adviser – Education Department
Douveri Henao – Department of Justice and Attorney-General
Navu Kwapena – Department of Environment and Conservation
Wila Saweri – Nutrition Unit – Health Department