

# Strategic Framework for **Underutilized Plant Species** Research and Development



with special reference to  
**Asia and the Pacific, and  
to Sub-Saharan Africa**



## About this document

### This document provides a Strategic Framework for research and development activities with underutilized plants for Asia, including the Pacific Islands, and for Sub-Saharan Africa.

With a vision to 2020, it is intended to provide guidance to research and development practitioners and investors from the public and private sector, helping them to identify areas of possible intervention and collaboration. The document was developed through a consultative process. It was drafted in January 2006 by the International Centre for Underutilised Crops (ICUC), with input from the Global Facilitation Unit for Underutilized Species (GFU). In early February 2006, a cross-section of over 200 experts in underutilized plant species research and development – representing universities, national agricultural and horticultural research systems, international research centres, government institutions, non-governmental organisations, regional networks, donor organisations and the private sector – was invited to provide feedback on the draft document. In addition, the draft document was posted on several relevant listservers, including FAO's NTFP Newsletter, the Forest Information Update, the Global NTFP Partnership listserver and the Alternatives to Slash-and-Burn listserver, as well as on the websites of ICUC ([www.icuc-iwmi.org](http://www.icuc-iwmi.org)) and GFU ([www.underutilized-species.org](http://www.underutilized-species.org)).

In March 2006, 27 participants from ten countries in the Asia and Pacific region (Jaenicke et al., 2006 a) met in Colombo, Sri Lanka for a two-day expert consultation. In May 2006, 31 participants from 13 countries in Sub-Saharan Africa (Jaenicke et al., 2006 b) met in Nairobi, Kenya for a similar consultation. During these meetings the draft documents were discussed and refined, problem trees were developed and operational plans for key activity areas were drawn from the problem-tree discussion. For Asia and the Pacific, the key areas identified were research, marketing, demonstrations, education, policy, and the general knowledge base; for Africa, they were research, marketing, education and capacity building, policy, knowledge, and partnerships.

By June 2006, input had been received from 78 individuals and institutions involved in research and development (see Annex 3); the input from donor

organisations and the private sector was weak. In total, about 35 percent of the individual recipients of the draft document responded.

Following the workshops, the strategy document was revised by ICUC, GFU and a group of reviewers comprising participants from the Colombo and Nairobi workshops.

Another extensive round of public consultation and input was realized in mid-2006 through the posting of the revised draft version on the websites of various partner organisations.

### Acknowledgements

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Strategic Framework for  
**Underutilized Plant Species**  
Research and Development



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*Growing and selling indigenous leafy vegetables provides farmers in Africa with added income.*

# List of acronyms

ACIAR	Australian Centre for International Agricultural Research	IPGRI	International Plant Genetic Resources Institute
ACP	Africa, Caribbean, Pacific countries	KIT	Royal Tropical Institute, Amsterdam
ACUC	Asian Centre for Underutilised Crops	LEISA	Low External Input Sustainable Agriculture magazine
ASARECA	Association for Strengthening Agricultural Research in East and Central Africa	MDG	Millennium Development Goal
AVRDC	The World Vegetable Centre	MEDUSA	Network on Identification, Conservation and Use of Wild Plants in the Mediterranean Region
BAMNET	Bambara Groundnut Network	MPa	mega Pascal
BMZ	German Federal Ministry for Economic Cooperation and Development	MSSRF	MS Swaminathan Research Foundation
CBD	Convention on Biological Diversity	NEPAD	New Partnership for Africa's Development
CGIAR	Consultative Group on International Agricultural Research	NTFP	Non-timber forest product
CIHEAM	International Centre for Advanced Agronomic Studies in the Mediterranean	NUS	Neglected and underutilized species
CoP	Conference of the Parties	ODA	Overseas Development Administration (now DFID)
CORAF-WECARD	West and Central African Council for Agricultural Research and Development	PGR	Plant genetic resources
CTA	Technical Centre for Agriculture and Rural Cooperation ACP-EU	PNG	Papua New Guinea
CWANA	Central and West Asia and North Africa	PROSEA	Plant Resources of South East Asia Foundation
DFID	UK Department for International Development	PROTA	Plant Resources of Tropical Africa Foundation
DONATA	Dissemination of New Agricultural Technologies in Africa	R&D	Research and development
EU	European Union	REGEN	Resources Genetiques (an EU Programme)
EU-FP6	European Union's Sixth Framework Programme for Research and Technological Development	SADC-FANR	Southern African Development Community's Food, Agriculture and Natural Resources Directorate
FAO	Food and Agriculture Organization of the United Nations	SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice (of the CBD)
FARA	Forum for Agricultural Research in Africa	SDC	Swiss Development Corporation
GEF	Global Environment Facility	SEANUC	Southern and East Africa Network on Underutilised Crops
GFAR	Global Forum for Agricultural Research	SGRP	System-wide Genetic Resources Programme
GFU	Global Facilitation Unit for Underutilized Species	SME	Small and medium-sized enterprise
GTZ	German Technical Cooperation Agency	SPC	Secretariat of the Pacific Community
ICRAF	The World Agroforestry Centre	TShs	Tanzanian Shillings
ICUC	International Centre for Underutilised Crops	TVN	The Vetiver Network
IFAD	International Fund for Agricultural Development	UC	Underutilized crop
IITA	International Institute for Tropical Agriculture	UMS	Underutilized Mediterranean species
INBAR	International Network on Bamboo and Rattan	UPS	Underutilized plant species
IPCC	International Panel for Climate Change	USAID	United States Agency for International Development
		USD	United States dollar
		UTFANET	Underutilised Tropical Fruits for Asia Network
		UTVAPNET	Underutilised Tropical Vegetable for Asia and the Pacific Network
		WCHR	World Conference on Horticultural Research
		WHO	World Health Organization

# Executive Summary

1. The world is presently over-dependent on a few plant species. Diversification of production and consumption habits to include a broader range of plant species, in particular those currently identified as 'underutilized', can contribute significantly to improved health and nutrition, livelihoods, household food security and ecological sustainability. In particular, these plant species offer enormous potential for contributing to the achievement of the MDGs, particularly in combating hidden hunger and offering medicinal and income generation options. They are also closely tied to cultural traditions, and therefore have an important role in supporting social diversity.
2. Recognition of the cultural, economic and food value of indigenous biodiversity is growing. Yet while there is increasing interest in research and development activities with underutilized plant species, these efforts require heightened direction and focus.
3. This paper provides a Strategic Framework for underutilized plant species research and development activities. Developed through wide consultation, it aims to avoid duplication of effort and to help cover gaps in current knowledge, while allowing outputs and approaches to be synthesised regionally. The Framework acts as a roadmap to guide stakeholders as they develop the work plans needed to generate new knowledge, lobby policy makers, or develop markets, for example. It will also guide efforts to set both research and funding priorities.
4. Focusing on the differing needs and circumstances of two world regions – Asia and the Pacific, and Sub-Saharan Africa – the Strategic Framework outlines the outstanding challenges and opportunities to be considered in promoting increased use of these plants: growing urbanisation, international trade, climate change, and health care are major areas of direct relevance. Although underutilized plant species have great potential for helping to address important concerns in these areas, the full development of their potential is hampered by lack of awareness in society, as well as by lack of relevant capacity within the research community. At the same time, these plant resources – and the land they are grown on – are increasingly threatened by global and local pressures.
5. An integrated, partnership approach is proposed, focusing on the following intervention areas to generate maximum impact: knowledge generation, communication, capacity building, policy improvement and market development.
6. Because of the complexities involved in developing the potential of underutilized plant species, clear concepts for action need to be formulated and made widely known, and consortia of complementary partners need to be formed. The roles of the diverse partners must be clarified and coordinated. Such partners include international and national agricultural and horticultural research organisations, advanced research institutions, non-governmental organizations (NGOs), community based organisations (CBOs), private companies, national governments, regional and international organisations, and donors and funding agencies. Regular discussion with the relevant desk officers in such funding agencies is recommended – to raise awareness of underutilized plants' value, and to devise new research paths jointly.
7. The document reviews current activities, provides examples of success and emphasizes the need to improve resource mobilization in support of underutilized plant species research and development, including urgent work to collect baseline information and formulate meaningful indicators to guide future action.



*Maintaining the genetic diversity of grains such as fonio (*Digitaria exilis*) in community seed banks is an important contribution to food security.*

# Introduction



*Wild fruits provide vitamins and minerals especially to women and children.*

Despite massive development efforts over the past 50 years, people in many countries – in particular in Sub-Saharan Africa, South Asia and the Pacific – still lack access to primary health care, suffer from malnutrition and have limited options for generating even a modest income.

Because of population pressure and increasing urbanisation, highly productive agricultural land is increasingly being used for urban development, placing extreme pressure on the remaining agricultural land and increasing the risks of degradation or erosion. These difficulties are made more acute by over-dependence on a few plant species (Box 1). Diversifying production and consumption of a broader range of plant species (including those currently identified as 'underutilized', see Box 2) can, therefore, contribute significantly to improved health and nutrition, income generation and ecological sustainability.

## Box 1: Problem Statement

The underlying problem can be formulated as:

**Over-dependence on a few plant species exacerbates many acute difficulties faced by communities in the areas of food security, nutrition, health, ecosystem sustainability and cultural identity.**

## Box 2: Definition of 'underutilized species'

It is difficult to define just what qualifies as an 'underutilized species'. Terms such as 'underutilized', 'neglected', 'orphan', 'minor', 'promising', 'niche' and 'traditional' are often used interchangeably to characterise the range of plant species that are the focus of this document. For this Strategic Framework, we have used the following definition: **those species with under-exploited potential for contributing to food security, health (nutritional/medicinal), income generation, and environmental services.**

This definition of underutilized plant species can also be illustrated by examples of success:

### Species for fighting hunger and malnutrition –

In South Asia, the little millets provide nourishing flour that can be mixed with rice flour, offering longer shelf-life, and made into healthy snacks. Millets have a higher micro-nutrient content – including calcium and iron, vitamins like niacin, and sulphur-containing amino acids – and contain more soluble fibre than rice or wheat. These grains also have a low glycaemic index, making them attractive health foods (MSSRF, n.d.).

**Species for medicinal use** – *Artemisia annua* is a plant with anti-malarial properties that has been used for over two millennia in Chinese traditional medicine. Each year, there are over 500 million cases of malaria worldwide; of the more than 1 million people whose deaths are directly linked with malaria, 90 percent are children. Because synthetic products are unaffordable for most of the rural poor, people naturally revert to herbal drugs. And although the efficacy and the potential associated risks of *Artemisia* products have not yet been fully studied, the potential of *Artemisia* and other species has generated much interest amongst research institutions in the West and international agencies such as WHO. In the first quarter of 2006, a two-month electronic discussion forum dedicated to *Artemisia* was moderated by the Dutch Royal Tropical Institute (KIT) and a workshop on herbal antimalarials was convened by the World Agroforestry Centre (Simons et al., 2006). Furthermore, several locally-made *Artemisia* products have been released.

**Species for income generation** – Myriad tropical fruits, such as *Annona* spp. (soursop, sweetsop, cherimoya etc.), *Aegle marmelos* (beli), *Feronia limonia* (wood apple) and *Choerospondias axillaris* (lapsi), can be processed by small-scale

entrepreneurs into juices, jams, candy etc. and sold in community shops or local supermarkets. Dhammika Perera is a Sri Lankan who currently earns Rs 50,000 (USD 500) monthly from his fruit processing enterprise – more than half of the family income. He started this enterprise after attending an ICUC training course in 2004 on processing and marketing underutilized crops. Mr Perera now employs ten staff to meet the demand for his products, and because his business has increased the demand for fresh beli, wood apple and soursop, local producers have increased their household income as well. On July 12 2006, Mr Perera received the Sri Lanka Standards certification for his fruit juice products, thus further strengthening his position amongst local competitors.

**Species important in cultural heritage** – The Aztecs believed that amaranth (*Amaranthus* spp.) seeds had supernatural powers and used them in ceremonial dishes associated with human sacrifice. In the 16th century, amaranth was forbidden by the Conquistadores, who wanted to root out these practices; amaranth grain was reduced to only a few remote areas of Mexico and the Andes. Today it is highly valued culturally in Peru, where during carnival festivities women dancers often use the red amaranth flower to paint their cheeks; they then dance carrying bundles of amaranth on their backs as if they were babies. The genus is receiving increasing attention because of the nutritional properties of the grain and leaves and can now be found throughout the world (Stallknecht and Schulz-Schaeffer, 1993).

**Species for ecological protection** – Vetiver grass (*Vetiveria zizanioides*) is used for soil stabilisation: when grown in contours along a slope, its dense root system acts as a 'living soil nail'. Vetiver roots, which have an average tensile strength of 75 MPa, improve the shear strength of soil by between 30 and 40 percent. The ability of vetiver to protect vital infrastructure in the face of extreme weather events has been demonstrated globally, for instance during Hurricane Mitch in Central America in 1998 (TVN, n.d.). In addition, vetiver is used for thatching, rope making, basket weaving etc., and its roots contain a valuable oil that is used in the perfume industry as a base for aftershaves.



Processing underutilized fruits can provide a significant increase in family income.

## Introduction *continued...*

Adaptation studies such as here for *Embllica officinalis* (amla) in India are an important part of understanding underutilized plants' ecological potential.



In recent years, underutilized plants have come out of the shadows and are moving fast into the limelight of rural development (see Annex 1 for some milestones and Box 3 for factors influencing today's interest in such species). Several national research systems are supporting work on these plant species, though not to the same extent as research on industrial and staple crops such as oil palm, rubber, cocoa, tea, wheat, rice etc. Policy makers and funding agencies are now recognising the value of indigenous biodiversity for diversification of farming systems, which will in turn help to buffer the risks of environmental and economic disasters (CGIAR, 2005). However, these efforts need direction and focus.

This is not the first strategy paper for underutilized crops (IPGRI, 2002; Gündel et al., 2003). Nonetheless, the need for a revised joint framework for activities with neglected and underutilized plant species was aired at several gatherings of partners in 2005. The partners identified several reasons for this: the importance of avoiding duplication of activities on these highly promising species; the desire to avoid leaving gaps where a potential for utilisation is more difficult to perceive; and the need for more regional syntheses of outputs and approaches. The formulation of the strategy began with an electronic consultation process initiated by ICUC, GFU and IPGRI in February 2006. This was followed by workshops of experts in Colombo (March 16-17, 2006) and in Nairobi (May 24-25, 2006). A group of volunteers drawn from these meetings contributed to the further revision of the strategy document. In drafting this Strategic Framework, we were guided by the principles outlined in Box 4.

### Box 3: **Some factors influencing today's increased interest in underutilized plants**

- Their role as alternative sources of income
- Collapse of commodity prices
- Greater appreciation of biodiversity's role in enhancing livelihoods
- Increased participation of communities in setting research agendas
- Stronger national agricultural research systems, willing to invest beyond primary commodities
- Search for cultural identities in a globalised, more mobile world
- Demand for traditional food in large multi-ethnic cities
- Better understanding of the limits of the Green Revolution
- Greater attention to gender-sensitive research

### Box 4: **Guiding principles**

Work on underutilized species, whether in research or development, requires a collaborative, open minded spirit that recognises and respects the complexity and interaction of social, economic and environmental factors in the development of underutilized-crop products.

Our approach is people-centred, pro-poor and gender-sensitive. It is founded on respect for the intellectual property of communities and adheres to relevant international codes of conduct, national legislation and international treaties governing germplasm access, movement and exchange.

Our research will contribute to improving livelihoods through a high-quality science-based approach.

# Placing underutilized plant species in context

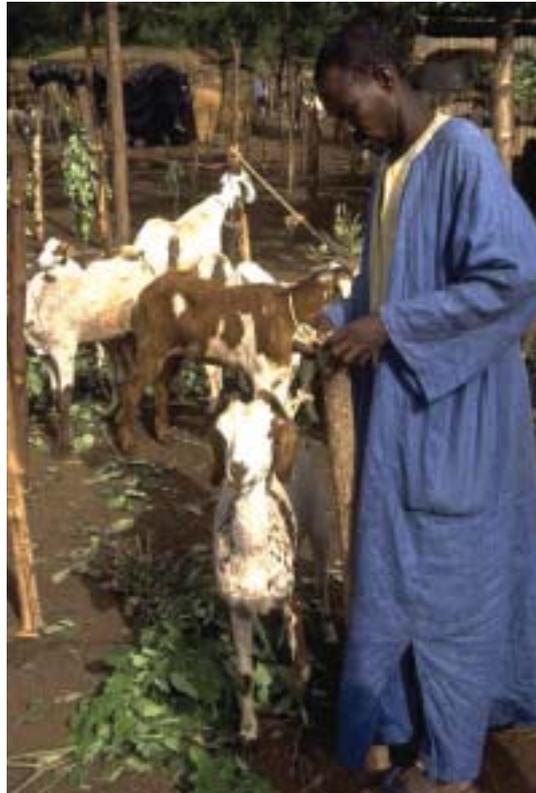
Global food security has become increasingly dependent on a handful of crops. Over 50 percent of the daily global requirement of proteins and calories is met by just three crops – maize, wheat and rice (FAO, 1996) – and only 150 crops are commercialised on a significant global scale. On the other hand, ethnobotanic surveys indicate that, worldwide, more than 7,000 plant species are cultivated or harvested from the wild (Rehm and Espig, 1991; Wilson, 1992).

These species:

- Represent an enormous wealth of agrobiodiversity and have great potential for contributing to improved incomes, food security and nutrition, and for combating the 'hidden hunger' caused by micronutrient (vitamin and mineral) deficiencies
- Are strongly linked to the cultural heritage of their places of origin
- Are mainly local and traditional crops (with their ecotypes and landraces) or wild species whose distribution, biology, cultivation and uses are poorly documented
- Tend to be adapted to specific agro-ecological niches and marginal land
- Have weak or no formal seed supply systems
- Are recognized to have traditional uses in localized areas
- Are collected from the wild or produced in traditional production systems with little or no external inputs
- Receive little attention from research, extension services, farmers, policy and decision makers, donors, technology providers and consumers
- May be highly nutritious and/or have medicinal properties or other multiple uses.

The very existence of these species may be threatened by their relative neglect by science and development, and by the increase in area under production to higher-yielding and better researched crops. In Africa, for example, exotic fruit trees are taking over land once planted to indigenous fruit trees (Antoine Kalinganire, pers. comm.) Studies also demonstrate the replacement of local varieties by improved, high-input varieties (FAO, 1996); this may lead to a narrowing of livelihood options for the poor.

There are major gaps in our knowledge about these neglected and underutilized species and their



*Some underutilized plants play an important role as livestock feed.*

ecology. Our capacity to conserve them and improve their yield and quality is also limited. Little has been done to identify the most effective means of commercialisation or the best marketing and policy frameworks to enable us to promote their use and maximise their economic value.

All of these factors represent obstacles to the successful promotion and conservation of underutilized plant species.

Although theories vary as to why certain plant species are underutilized, most widespread amongst them is the belief that this resulted from a combination of serendipity and chance selection processes that took place several times in human history; this, coupled with a few crops' adaptability to varying climatic conditions, made these few crops agricultural favourites (Janick, 1991). Once these favourites gained a head start on their competitors, selection and seed exchange concentrated on them, speeding up their domestication. Nonetheless, it was only during the mechanisation of agriculture in the 19th century that the real reduction to only a handful of major crops took place.

# Contribution to the Millennium Development Goals

*The use of biodiversity plays a vital role in ridding the world of poverty and hunger.*



The UN Millennium Development Goals (MDGs; Box 5) provide important guidelines for research and development efforts in the short and medium term. The International Plant Genetic Resources Institute (IPGRI), together with the MS Swaminathan Research Foundation and the Global Facilitation Unit for Underutilized Species, have examined the contribution underutilized plants can make to meeting the MDGs (IPGRI et al., n.d. a), pointing out the vital role of biodiversity in the efforts to rid the world of poverty and hunger. FAO (2005) has also concluded that combating hunger and malnutrition is a necessary precondition for meeting any of the other MDGs. This places great responsibility on researchers and development experts working with underutilized plants and highlights the importance of their work.

## Box 5: The Millennium Development Goals

- 1 Eradicate extreme poverty and hunger
- 2 Achieve universal primary education
- 3 Promote gender equality and empower women
- 4 Reduce child mortality
- 5 Improve maternal health
- 6 Combat HIV/AIDS, malaria and other diseases
- 7 Ensure environmental sustainability
- 8 Develop a global partnership for development

The reduction in hunger that has been achieved worldwide to date is a great accomplishment. Nonetheless, there are nutritional issues that still have not been addressed. In particular, hidden hunger, or the lack of micronutrients, vitamins and other essential dietary components, is greatly neglected (Frison, 2004). Close to 120 million children suffer from vitamin A deficiency and its many effects, the most serious amongst them being blindness. About a third of the world's population is anaemic as a result of iron deficiency. Although dietary supplements can help in combating these deficiencies, they are beyond the reach of the poorest people. On the other hand, obesity, cardiovascular diseases and type II diabetes are on the increase, even in developing countries, because of oversimplified diets.

The challenge of the MDGs is not only to halve hunger by 2015, but also to attack hidden hunger. For most people, dietary diversity represents the most effective answer to this problem. Many underutilized grains, fruits and vegetables will have a crucial role to play in providing the solution (IPGRI et al., n.d. b), not only in the developing world but in high-income countries as well.

Similarly, over 75 percent of the rural population in Asia and Africa consults traditional healers or uses traditional medicinal plants when ill. Land clearance, population pressure and unsustainable harvesting methods, however, have contributed to the severe depletion of medicinal plant genetic resources, forcing many of the poor to pay exorbitant prices for 'Western' medicines or to go without treatment. Research and development with underutilized plant species offer opportunities for developing more sustainable production methods and producing standardised and safe medicines from these plants, thereby addressing MDGs 4 and 6.



# Challenges and opportunities

The regions addressed by this Strategic Framework (Asia and the Pacific, and Sub-Saharan Africa) are vast and represent a wide diversity in terms of status, speed and direction of development.

The following are general concerns that come to bear on the development of underutilized plant species in the areas of nutrition, urbanisation, trade, climate change and health care. Building on this document, specific plans can be developed by individual institutions. In designing this Strategic Framework, we have made assumptions about the factors that will affect underutilized plant species over the next 15 years (Box 6).

## Box 6: Assumptions

- Population growth will continue
- Agricultural land will be increasingly converted to non-agricultural purposes, thus increasing competition for the remaining land area
- Globalisation will allow more international exchange of knowledge and goods
- More people with better educations will enter the work force (especially in Asia)
- Diseases, such as HIV/AIDS and malaria, will continue to kill tens of thousands of productive people (especially in Africa)
- Domestic markets for new products will be increasingly influenced by international market forces, such as quality standards
- Growing urbanization may lead to an increased demand for convenience food and thereby to increased health problems associated with simplified diets (especially in Asia)
- Interest in ecotourism and in ethnic foods will increase
- Dependence of commodity crop farmers on the world market for inputs and sale of products will increase
- Awareness of intellectual property rights/access and benefit sharing policies will grow
- Effects of climate change will become more pronounced.

Whereas in general terms, fewer people are severely undernourished in Asia than in Africa (FAO, 2005), malnutrition – whether as a result of too little, imbalanced or too much food – is widespread in both regions. On the other hand, the incidence of **nutrition**-related non-communicable diseases, such as cardiovascular diseases or diabetes II, is increasing everywhere. In some areas, growth in economic prosperity is resulting in changes in consumption patterns that favour 'luxury foods': thus, people may switch to white bread from millet gruel, and to imported vegetables from the more nutritious traditional ones.

Increasing **urbanisation**, especially in South and Southeast Asia, has an effect on the production and supply of niche products, vegetables and processed goods. This offers new opportunities for underutilized plant species to enter niche markets, creating income and job opportunities in rural areas. Nonetheless, urbanisation also leads to prime agricultural land being used for housing, thereby increasing the stress on the remaining agricultural areas, which are often poor-quality; nonetheless, to meet growing demands, more – or higher quality – food needs to be produced on these lands.

**International trade** is changing quickly, with Asian countries contributing significantly to the global GDP. Nonetheless, many countries in Asia as well as in Africa are being left behind. Products from new or underutilized species are affected by non-tariff barriers to trade, such as food-safety regulations; domestic import regulations also may act as trade barriers. For this reason, domestic markets may offer better prospects for the commercialisation of underutilized plants. Boxes 7 and 8 provide examples from Asia and Africa.

## Box 7: An example from Asia

*Eleusine coracana* is one of the so-called minor millets that are enjoying something of a renaissance in parts of India and Nepal. Farmers and consumers are coming to appreciate the better qualities of the minor millets, which are being successfully re-branded as nutritious millets.

In the Kaski district of Nepal, a pilot project examined all aspects of the production chain, from the farmers' choice of varieties to consumer preferences. The project aimed to identify the best options for adding value to finger millet whilst promoting its benefits to consumers and policy-makers. In two villages, Kalabang and Ralmare, farmers identified their favoured traditional varieties and then worked with researchers to evaluate several improved lines. Of these, three in particular impressed the farmers because of their high yields and plump grains.

Now, the emphasis is on working in a participatory fashion with the modern lines to improve some of the traditional landraces, which people prefer for particular foods but that are difficult or unprofitable to grow.

Whilst farmers were working on production, others worked on public awareness, disseminating the good news about millets through radio, print, fairs and festivals, workshops and school programmes across the Kaski district. Surveys revealed that as a result of these efforts some groups of people –

amongst them intellectuals, diabetics, the younger generation and foreigners – increased their demand for millet. Micro-entrepreneurs told the same story. After the publicity efforts, department stores and others increasingly came looking for millet-based foods to sell in Pokhara, the main town of Kaski. Demand for millet grain quadrupled between 2001 and 2004. Sales of millet cookies increased even further: one micro-entrepreneur reported a leap from 50 to more than 600 packets a month in just 18 months. Whole new types of foods, such as millet *namkin*, a savoury snack, appeared on the market, with sales increasing twenty-fold over the course of a year.

The Kaski project is an example of successful collaboration amongst groups that run the gamut from international research centres to cooperatives and individual farmers, offering a series of lessons for consideration elsewhere. Farmers picked their preferred varieties and worked to improve local landraces, preserving the environmental benefits of the crop. Improved quality and supply made it attractive for industry to use millet. Micro-entrepreneurs played an essential role in the value-adding process. Finally, wide-ranging public awareness activities underpinned the whole effort by sensitizing urban and rural populations to the benefits of millet.

(Adapted from IPGRI et al., n.d. a)



*Food made from underutilized plants, such as minor millets, is increasingly popular amongst the younger generation.*

**Climate change** forces people in many low-lying areas to migrate to higher ground, where they must cope with saline soils, tropical storms of greater ferocity, precipitation, and extended spells of drought (IPCC, 1998). Whilst niche plants are often thought of as being hardier, more resilient and better adapted to extreme conditions, this needs to be demonstrated and verified, and their value to rural livelihoods must be assessed.

Communicable diseases, such as HIV/AIDS, tuberculosis and malaria, are particularly prevalent in Africa. In both

Africa and Asia, the majority of the rural population consults traditional healers for medical advice and **health care**.

## Challenges and opportunities *continued...*



*In Africa and Asia, the majority of the rural population uses traditional medicines for health care.*

Yet while many traditional plants have medicinal properties, their natural resource base is often threatened by unsustainable harvesting techniques that are prompted by population pressure, land conversion or other factors. Indigenous knowledge also needs to be mapped before it is lost, and research into active compounds and sustainable harvesting methods is necessary.

Against this background, the development of underutilized plant species is still hampered by a general lack of awareness in all sectors of society and a lack of the necessary capacity within the research community.

### Box 8: An example from Africa

Mr Pallagyo – 48 years old and married, with four children – lives in Nambala village, in the Arumeru District near Arusha in Tanzania. His enterprise, dedication and hard work have boosted his income from TShs 400,000 a year (about USD 350) to more than TShs 2,500,000 (USD 2,300) over the past five years and have offered similar opportunities to the many people he now employs.

His steadfast focus has been on African eggplant (*Solanum aethiopicum*), an important indigenous vegetable crop of Sub-Saharan Africa. Mr Pallagyo started off with less than a hectare of land, on which he grew three varieties: 'Tengeru white' and 'Manyire green', which are local varieties, and 'DB3', a new line bred by the World Vegetable Center, which out-performs the other two. Mr Pallagyo prefers Tengeru white because it tastes better and produces larger, heavier fruits. His customers like DB3, but seed is currently in very short supply.

Mr Pallagyo has concentrated on quality and marketing. He employs local women to harvest his crops, which must be done even when demand is low, as leaving fruits on the plant inhibits the formation of flowers. Each day the women pick about 10 to 15 buckets of eggplant, earning around USD 2.50. Mr Pallagyo also buys from other farmers before passing the whole harvest on to workers who sort, grade and pack the eggplant. The workers carefully evaluate the fruits on the

basis of colour: creamy white fruits are preferred, whilst reddish and yellowish ones are rejected, as are mottled, rusted and immature fruits. The use of two grades - one for the largest, undamaged, cream-coloured fruits and the other for the rest - ensures that Mr Pallagyo gets the best possible price for the produce.

Access to markets is a problem for all rural farmers. Initially, Mr Pallagyo used local transportation to reach the Tengeru market, where he sold his produce to retailers. His initial success enabled him to invest in a bicycle, which cost TShs 28,000. Better transport brought bigger profits and a permitted further investment of TShs 700,000 in a motorbike. As the business grew, he was able to afford a second-hand pick-up truck, which has further enhanced his capacity to collect the harvest and deliver the sorted and graded produce. A mobile phone has also become an essential business tool, enabling Mr Pallagyo to stay in touch with his customers and to keep on top of market fluctuations.

In addition to his family's improved standard of living, Mr Pallagyo has added an extra half a hectare to his land. His enterprise has also benefited his neighbours, who now have employment and a market for their own produce. Finally, in the markets, customers are assured of a steady supply of high-quality African eggplant.

(Adapted from IPGRI et al., n.d. a)



# Strategy

## Research and development to realize the full potential of underutilized plant species, as foreseen in the vision for 2020 (Box 9), requires action on many fronts.

It is crucial to ensure that underutilized plants are part of pilot initiatives, development projects and entrepreneurial endeavours. Rather than thinking of a list of priorities that need to be ticked off from the top downwards, we see the needed activities as part of a large puzzle. Numerous partners will need to participate in diverse activities, each contributing to

the completion of the overall picture according to their particular strengths and capacities.

In this respect, work on traditional crops that are relatively important economically (such as jackfruit in Asia or bambara groundnut in Africa) is just as important as work on traditional species that have their greatest potential in local and informal markets, and that are important for household food security and other needs of the poor (such as some of the minor vegetables). Work towards food security is equally as important as work to develop new sources of income from non-food products/species. Each of these activities increases the value of these plant resources and ultimately allows the poor to strengthen their livelihoods.

### Box 9: A vision for underutilized plant species in 2020\*

By 2020 the collective efforts of research and development organizations, in true partnership with local communities and aided by increased access to communication technology, will raise awareness and stimulate the use of underutilized plant species.

This joint effort, together with the implementation of favourable policies, will allow underutilized plants to make significant contributions to improved food security, nutrition, health and incomes amongst the rural and urban poor. The use of these plants will also contribute to the sustainable management of fragile ecosystems.

Specifically, research and development with underutilized plant species will contribute to:

- better health amongst vulnerable groups, such as pregnant women, breastfeeding mothers, children and the elderly
- better educations for children thanks to school feeding programmes using products from underutilized plants that will result in better health and therefore in improved attendance and performance in school
- reduction in the incidence of malnutrition-related non-communicable diseases, such as diabetes II and cardiovascular diseases

- availability of improved health care options through better knowledge amongst health practitioners of the medicinal properties of a wide range of plants
- increased income opportunities through the development of micro-enterprises for processing and selling food and non-food products from underutilized species and the encouragement of special micro-credit systems for this purpose
- well-maintained and well-used *in situ* and *ex situ* germplasm collections of underutilized species, in recognition of national and regional responsibilities to conserve these unique genetic resource for future generations
- adoption of more sustainable and diverse land-use systems, allowing farmers to harness existing biodiversity without eroding valuable existing genetic resources.

Appropriate information and germplasm exchange protocols will help to protect individual, national and regional intellectual property rights, underpinning this effort.

\* Developed during the expert workshops in Colombo and Nairobi.

# Priority areas for action

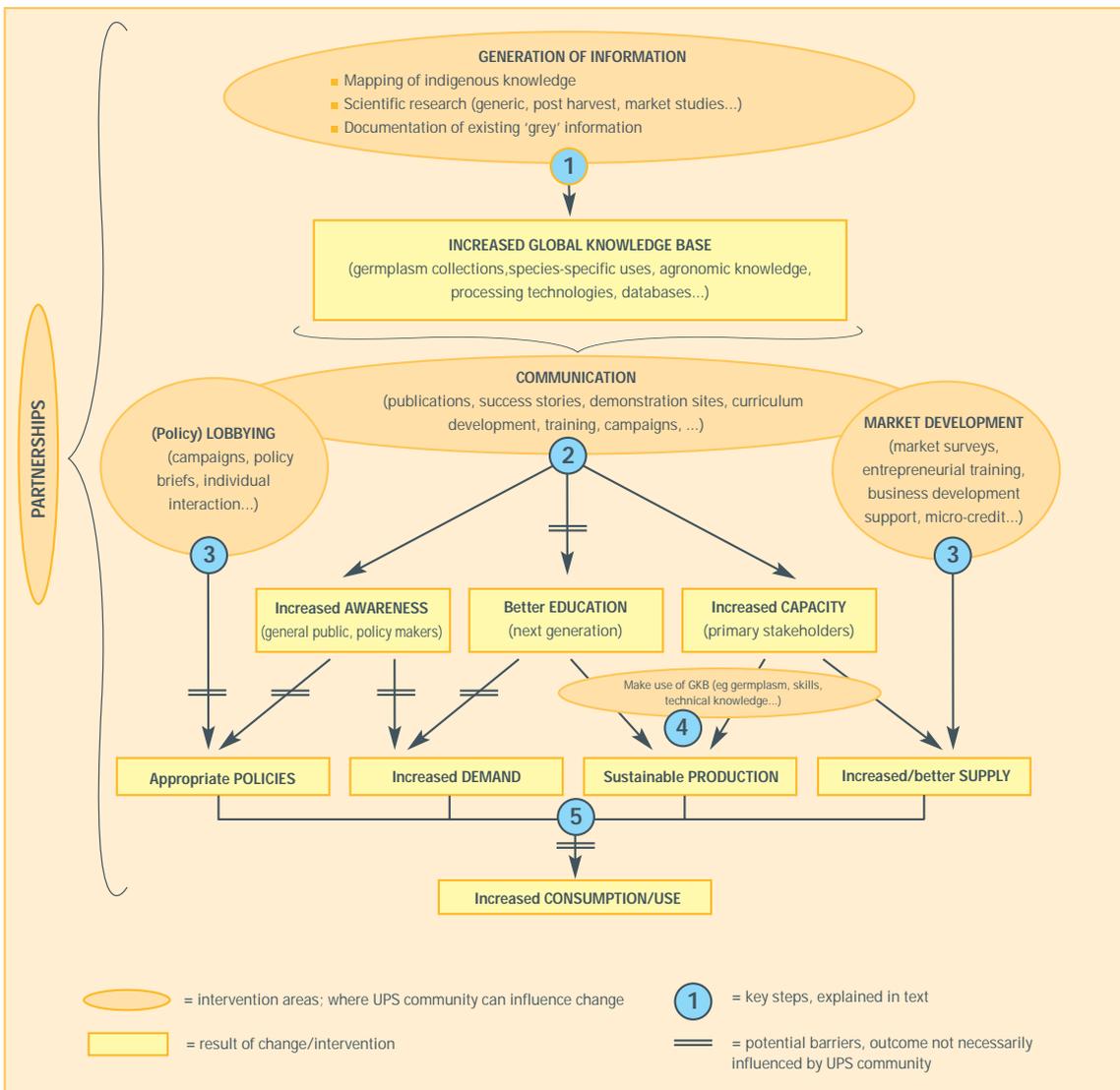
This Strategic Framework attempts to highlight specific fields of activities, and by doing so to promote coordinated efforts to tackle as many parts of the puzzle as possible. Linkages between public and private organisations, advanced and less-advanced institutions, major and minor crop researchers, as well as research with practical applications, are the centrepiece of this Framework.

Problem trees (Annex 2a and b) have been developed to demonstrate how various challenges are interlinked in causal chains. These trees were developed separately for the Africa and Asia-Pacific regions to ensure that regional differences were not lost. Entry

points for maximum impact can be identified at the branch tips of the trees for each of the two regions. A diagram of global intervention points (Figure 1) has been developed to facilitate the quick visualisation of opportunities for intervention by the research and development community dealing with underutilized plant species. These trees and diagram will be further refined as more dialogue and information exchange takes place.



Figure 1: **Intervention areas for the promotion of underutilized plant species**



The development of micro-enterprises for processing and selling food products from underutilized species will stimulate the use of underutilized plants, such as jackfruit.

## Strategy continued...



*The documentation of local processing methods is an important addition to the global knowledge base.*

### The main intervention areas for maximum impact are:

1. **Generation of new knowledge** through mapping of indigenous knowledge and further scientific research to increase the global knowledge base
2. Better **communication** of this information in order to **raise awareness** and **build capacity** amongst stakeholders and ultimately increase demand for underutilized plants and their products through demonstration sites, collection of success stories, targeted campaigns, development of school curricula and training
3. Influencing **policy** at all levels to remove barriers to production and marketing
4. Improved **market development** through practical interventions, entrepreneurial training and fostering of public-private partnerships at all stages of the value chain to improve the supply and demand of underutilized plants and their products.

These intervention areas are supported by improved interaction and **partnerships** amongst all stakeholders.

Figure 1 shows the links between these intervention areas and their expected effects. The diagram also indicates potential barriers that are beyond the immediate control of the primary stakeholder group. These are primarily areas of human behavioural change: whilst we can create an enabling environment, we cannot force increased demand or consumption of underutilized plants and their products per se.

The following are the key steps:

1. The global knowledge base will be enhanced by scientific research, mapping of indigenous knowledge and documentation of existing information that at present may not be accessible.
2. Through targeted communication in a variety of formats, this information will raise the awareness of the general public about the value of underutilized plants; relevant information will feed into curriculum development to inform the next generation and will also contribute to capacity building amongst the primary stakeholders: the underutilized plant species community itself.

3. Two special cases of 'communicating knowledge' have been highlighted. Firstly, **lobbying** among policy makers and other influential interest groups in order to remove existing barriers – for example trade barriers – and arrive at appropriate policies; increased public awareness will also contribute to this goal. Secondly, **market development** in order to improve the supply of quality products; increased capacity will also contribute to this goal. A 'barrier' has been inserted in Figure 1 to indicate that, whilst every effort will be made to achieve a positive outcome through policy lobbying, the final result depends on a variety of factors outside our immediate control. Market development, which includes the development of functioning market chains, provision of relevant training and support for business development, is more predictable, and success in this area is more likely.

4. The prerequisites for continuing targeted research and development activities that will use and further increase the global knowledge base include increased capacity amongst the primary stakeholders and a better educated younger generation. This will produce an iterative process that will enable sustainable growth in the production of and demand for underutilized plants and their products.

5. Finally, assuming that appropriate policies, increased demand, sustainable production and increased/better supply coincide, the goal of increased consumption/use of underutilized plant species to address the overall development problem will be reached. To achieve this, however, the aforementioned potential barriers need to be overcome; to this end, more effort, interaction and lobbying will be required.

Some examples of possible short-to-medium term interventions are given below.

### Generation of information

- Determine baselines for future informed impact analysis
- Carry out analysis of gaps in indigenous knowledge
- Carry out studies on specific cultural practices involving underutilized species
- Assess available genetic resources of specific species (location-specific)

- Support research for genetic enhancement of priority species
- Engage in crop management studies
- Carry out post-harvest handling/processing research
- Use biotechnology, where appropriate, to speed up development (specifically genomics and mapping activities)
- Maintain diversity within species through appropriate protocols
- Carry out scientific studies on nutritional value and for validation of traditional knowledge
- Carry out marketing studies
- Analyse, develop and strengthen value chains
- Develop certification/biosafety standards
- Develop a marketing database
- Support the documentation of existing knowledge
- Engage in surveys to identify promising species
- Carry out impact analysis

### Communication

- Demonstrate production, productivity and economic benefits
- Share practices that have cultural value
- Encourage/facilitate South-South exchange
- Support the promotion of local foods in schools, hospitals and other public institutions
- Engage in continuing communication to all stakeholder groups
- Support the development of syllabuses in primary schools as well as at secondary and tertiary levels
- Organise scientific workshops and conferences to foster information exchange amongst researchers
- Develop and manage a moderated 'community of interest'
- Run community blogs
- Develop an electronic journal
- Engage in the development of appropriate training and information materials (e.g. DVDs, demonstration gardens)
- Interact with appropriate 'channels' of information (e.g. celebrities, church groups, private sector)
- Develop TV/radio programmes

### Policy lobbying

- Initiate national dialogues/consultations on specific issues
- Develop policy guidelines/briefs based on case

studies

- Increase policy awareness through 'champions'
- Capitalise on existing regional networks for policy dialogue
- Enlist support from the grass-roots level
- Organise a high-level policy platform on underutilized plant species
- Get involved in dialogue with relevant government offices on national poverty reduction strategies
- Interact with relevant partners on certification, biosafety standards and other non-tariff barriers, nationally and internationally

### Market development

- Provide entrepreneurial training for producer groups
- Organise buyers-suppliers fora
- Organise demonstrations and trade fairs
- Adapt credit and grant schemes to encourage all relevant stakeholders
- Carry out market surveys (consumer preference, risks, partners, prices, marketing strategies etc.)
- Provide technical support for processing, packaging, labelling, certification etc.

### Partnerships

- Form strategic alliances/consortia
- Encourage multidisciplinary research teams/regional networks
- Identify champions
- Create public-private partnerships for marketing of products



*Market surveys are needed to study consumer preferences, risks, partners, prices, marketing strategies, etc.*

# Implementation

This Strategic Framework is meant to provide a roadmap for actors in underutilized plant species research and development.

It cannot prescribe individual institutions' work plans, nor can it take responsibility for the implementation of specific activities. Single organisations might be overwhelmed by the challenges and the task ahead. Nonetheless, the initiators of this consultation hope that the process itself has fostered closer collaboration and a sense of 'pulling the same string' so that increased cohesion and coordination will follow. ICUC, IPGRI and GFU will, as global actors, honour their responsibility to continue to support regional and national underutilized plant species research and development through their partnership programmes.



*There are many small, medium-sized and large private companies that are interested to develop a greater variety of underutilized species products.*

Whereas it is recognised that increased funding is essential to enable increased activities with underutilized plant species, any request for financial support to any agency needs to be built upon a solid case. Therefore, clear concepts for action need to be formulated and made readily available, and consortia of complementary partners need to be formed. Examples are provided in Boxes 10 and 11. Informed ongoing dialogue with funding agencies is necessary to ensure that underutilized species research is not carried out in reaction to calls for proposals (often small ones), but rather is shaping the funding agenda of donor agencies.

If feasible, institutions will prioritise activities and develop operational plans in accordance with this Strategic Framework. National coordinating offices could be named to ensure greater visibility and voice within the national agricultural research and development systems.

## Box 10: A champion for partnerships

"Bambara groundnut is a rare example of a long-term, multidisciplinary and international research commitment to any underutilized crop. By integrating research partners in Africa, India and Europe we now have a coherent body of knowledge and expertise that spans the genomics, physiology, agronomy, nutrition, socio-economics and marketing of the crop. We also have a basis to advocate further research on bambara groundnut and apply our collective experience to many other underutilised species.

We started in 1988 at the University of Nottingham using departmental funds to support MSc projects. Then in 1991 we approached the EU and got our first major 4-year project in 1992. We got some support from other donors for short periods of time, but not before the first EU project had shown results in 1996. It then took four years until we got our second EU project which finished in 2004. BAMLINK, the follow-up, started in 2006, but by then the team was strong enough to keep the momentum up between projects."

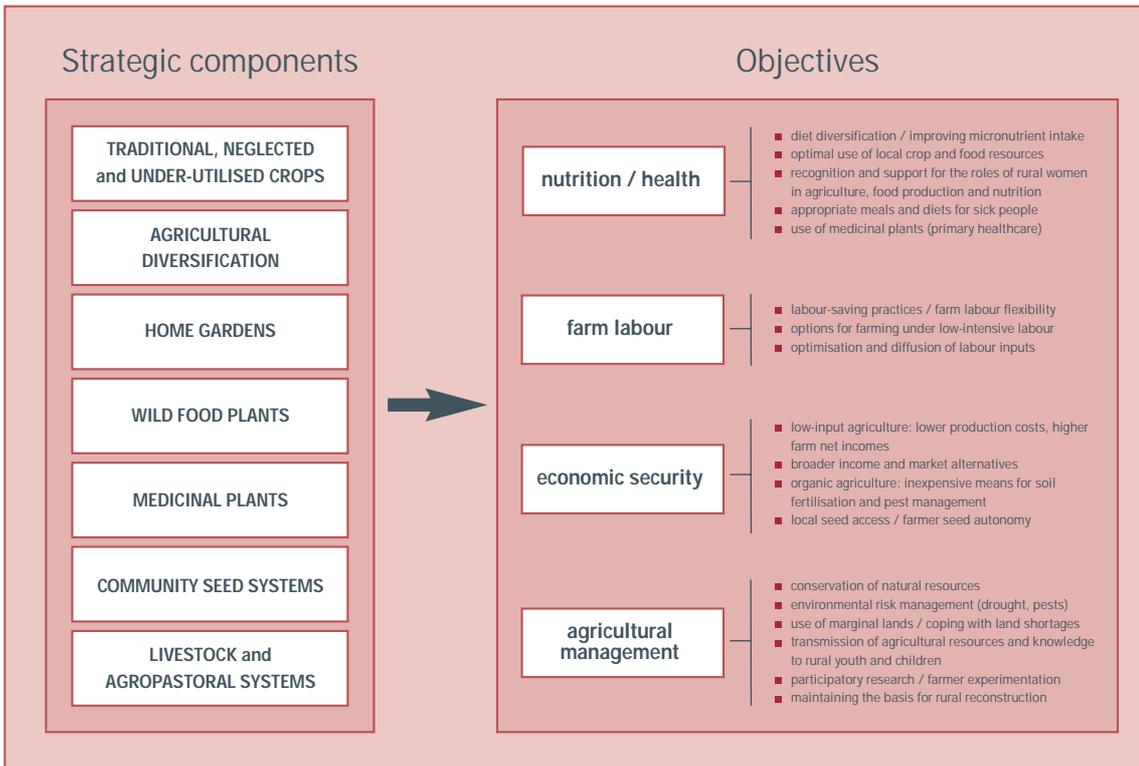
Sayed Azam-Ali, University of Nottingham, UK

## Roles of partners

Research and development activities with underutilized plant species are primarily carried out by international and national agricultural and horticultural research organisations, NGOs, CBOs and university departments.

There are many small, medium-sized and large private companies that are interested in developing underutilized species for their enterprises, some with a clear focus on community development and others through their corporate social responsibility departments.

**Box 11: An example of an integrated approach to tackling the problem of HIV/AIDS** (adapted from Garí, 2004)



*Public-private partnerships are beginning to emerge, such as for the domestication of *Allanblackia*. Here fruits are selected for propagation studies in a community nursery.*

Public-private partnerships are beginning to emerge and may have a major role to play in overcoming proprietary concerns (intellectual property rights) when using new technology – such as biotechnology – for research and commercialisation (Dawson and Jaenicke, 2006). There may also be a need for advanced research institutions to collaborate with less advanced ones in order to ensure the smooth transfer of methodologies developed during advanced research. Furthermore, there is a need for centres working on major crops to link with institutes working on minor crops so that lessons can be transferred from major to minor crops, and perhaps vice versa (Naylor and Manning, 2005).

The need for increased collaboration is evidenced by the number of networks formed over the past ten years (Williams and Haq, 2002). Important regional networks include dedicated plant genetic resources networks (for example the Pacific Agricultural Plant Genetic Resources Network, coordinated by the Secretariat of the Pacific Community), networks on a variety of specialty underutilized crops (such as the Bambara Groundnut Network) or commodity groups (such as UTFANET, for underutilized tropical fruits, in

Asia). Few survive, however, beyond the first few years of enthusiasm and external funding. In Africa, NEPAD, FARA and the Sub-Regional Organisations ASARECA, CORAF-WECARD and SADC-FANR can play a facilitating role in supporting underutilized plant species networks, or assist in integrating relevant activities into existing networks.

Regional and international organisations such as AVRDC, GFU, ICRAF, ICUC and SPC have the mission for and are active in coordinating, where appropriate, research prioritisation and impact assessment, research and technology development, and information dissemination and exchange.

# Implementation *continued...*



*The number of successful new enterprises in processing and marketing of underutilized plant products will be an indicator for impact.*

## *Ongoing activities*

Research and development with underutilized plants has concentrated so far on a small number of key activities: database inventories of useful species and experts, bibliographic resources, priority lists of species, germplasm collections of locally or regionally important species, horticultural/agronomic studies to improve productivity (domestication), and in some cases, post-harvest and processing studies. Very few have taken on the support of biotechnology methods (for propagation) and/or are studying species at the molecular level (for characterisation). There are a limited number of actors involved in marketing and business development activities specifically designed for products from underutilized plants. Often, these activities have been part of someone's 'hobby' or personal priorities. Whereas this has contributed to the establishment of very important collections (both data and germplasm), little of these resources have contributed thus far to larger rural development projects.

Annex 4 provides information about ongoing activities from some of the contributors to this consultation. This list, however, cannot provide a complete picture of ongoing activities; additional information about underutilized species experts can be found at [www.underutilized-species.org](http://www.underutilized-species.org). Further contributions are welcomed and will be included in later editions of this document.

## *Resource mobilisation*

Over the past decade, research and development with underutilized plants has been supported by a handful of dedicated organisations and foundations, for example ACIAR (Australia), BMZ (Germany), CTA, DFID (United Kingdom), the Global Environment Facility (GEF), the International Fund for Agricultural Development (IFAD), the Mac Knight Foundation, the Syngenta Foundation and USAID<sup>1</sup>. Although as a rule, individual countries have provided limited support, in some countries government support has been substantial, to the point that their national personnel capacity is now the main factor limiting further progress. The private sector's contribution is currently difficult to assess.

In order to tap into the funding available from these and other sources, continuing dialogue with the

relevant desk officers is recommended; this dialogue should aim at raising awareness about the value of underutilized plants and jointly conceptualizing and facilitating the development of relevant projects with the funding organisation. Partner organisations within countries or across regions will form consortia that will be ready to assemble and develop project concept notes and proposals when relevant calls are issued. Networks and fora, such as ACUC in Asia and FARA in Africa, are particularly valuable in developing critical mass and coordinated research agendas amongst partner institutions.

There is great potential for increasing **private-sector** interest in supporting work on products from underutilized plants. Dialogue with relevant companies, including the multi-nationals, is required.

ICUC, GFU and IPGRI will provide guidance in identifying promising funding sources and will endeavour to circulate relevant information to as wide a network of recipients as possible.

We see donors and funding agencies as integral partners in the development and promotion of underutilized plant species.

## *Measuring impact*

At present, very little baseline information is available against which the progress and possible success of strategies and activities with underutilized species can be measured. In particular, because of the complex mandate of research and development with underutilized plant species, which touches on several livelihood areas, secondary indicators such as number of children attending (and finishing) school may be used; these, however, are of questionable relevance. The number of new research and development projects undertaken by partner organisations is a similarly vague indicator, as this may demonstrate improved political will but not necessarily impact at the grass-roots level. Data on the number of new enterprises in processing and marketing of underutilized crop products may be collected from various national enterprise development agencies, but this information may not include informal businesses, and thus provides an incomplete picture. As a matter of urgency, baseline information needs to be collected and meaningful indicators need to be formulated.

<sup>1</sup> This list is not meant to be exhaustive.

# Strategy into action

## The way ahead

A strategy paper is not an end in itself. Once written, it needs committed actors for its implementation. So, how can we make the vision of increased awareness and utilisation of underutilized plants a reality?

This document provides a framework within which stakeholders will be able to develop their work plans to contribute to specific parts of the puzzle, whether in the generation of new knowledge, communication, policy lobbying or market development. It provides guidance for the leaders of regional and sub-regional organisations and the directors of national agricultural and horticultural research systems in developing their research priorities. It also provides guidance for donor agencies and investors who may want to revisit their funding priorities.

The framework highlights the complexity involved in the promotion of underutilized plants. Activities are interlinked and happen simultaneously. ICUC, IPGRI and GFU are committed to supporting their partners, but it is up to every individual and institution to contribute to implementing the strategy by lobbying and raising awareness amongst the general public, donors and policy makers.

Many respondents requested a forum to exchange scientific information and research results; beyond hosting an e-information bulletin, we plan to organise an international conference on underutilized plant species, but funds need to be raised for this.

Although a considerable number of people involved in research and development with underutilized plants have been able to contribute during the consultation process, many have not been reached. For example, Latin America and the CWANA region have not had the opportunity to contribute through a regional workshop. Funds – and champions – are being sought to include these regions.

The process that has led to the development of this Strategic Framework is a starting point in the promotion of increased partnership and dialogue amongst stakeholders. Consultation began at the beginning of 2006. Since then a variety of processes have been observed (some of which resulted from the enhanced dialogue initiated by ICUC and GFU). Examples include the emergence of a number of new mechanisms for information exchange and the launch

of new initiatives, such as the AVRDC-led Global Horticulture Initiative. ICUC and GFU have also set up a working group on underutilized plants within the International Society for Horticultural Science. In addition, the INBAR-led GFAR Global Partnership on Non-Timber Forest Products is also now beginning to take shape.

This framework, and the action that will follow, allow us to draw new attention to the important contributions that underutilized plants can make to improved health and nutrition, income generation and ecological sustainability, through the diversification of production and the consumption of a broader range of plant species.

Let's continue to work together to make our vision a reality!



*The consumption of a broader range of plant species will be an important contribution to health and nutrition, income generation and ecological sustainability.*





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# Annex 1: Some milestones in activities with underutilized plant species, 1970 – 2005

## 1970s

- R&D focuses on major commodities (staples and industrial crops)
- High impact on hunger and poverty reduction achieved (Green Revolution)
- US National Academy of Science book published: *Underexploited tropical plants with promising economic value* (1975)

## 1980s

- Greater recognition of crops' wild relatives by the CGIAR
- Collecting missions conducted, e.g. IITA for *Vigna* species (1989)
- All Indian Coordinated Research Project on Underutilized Plants initiated (1982)
- Conference held: New Crops for Food and Industry (1987)
- ICUC founded (1988)
- First Purdue Symposium on New Crops held (1988)

## 1990s

- Increase in donor funding (EU, DFID, SDC, BMZ, the Netherlands, Japan, Italy)
- Projects launched at IPGRI (UMS, monographs)
- CIHEAM: Underutilized Fruit Crops in the Mediterranean Region (1994)
- Three Purdue Symposia on New Crops held (1991, 1995, 1998)
- FAO IV Technical Conference and GPA-Activity 12 convened (1996)
- ODA-ICUC international symposium held: Domestication, Production and Utilization of New Crops (1997)
- FAO *State of World's Plant Genetic Resources* report published (1998)
- EU Projects undertaken (RESGEN Programme)
- WCHR-Rome emphasis placed on underutilized horticultural species (1998)
- ICUC Fruits for the Future Project launched (1998)
- International Consultation by CGIAR Germplasm Resources Policy Committee carried out (1999)
- AVRDC work on indigenous African vegetables starts
- Networks launched (MEDUSA, BAMNET, UTFANET, SEANUC, PROSEA, etc.)

## 2000s

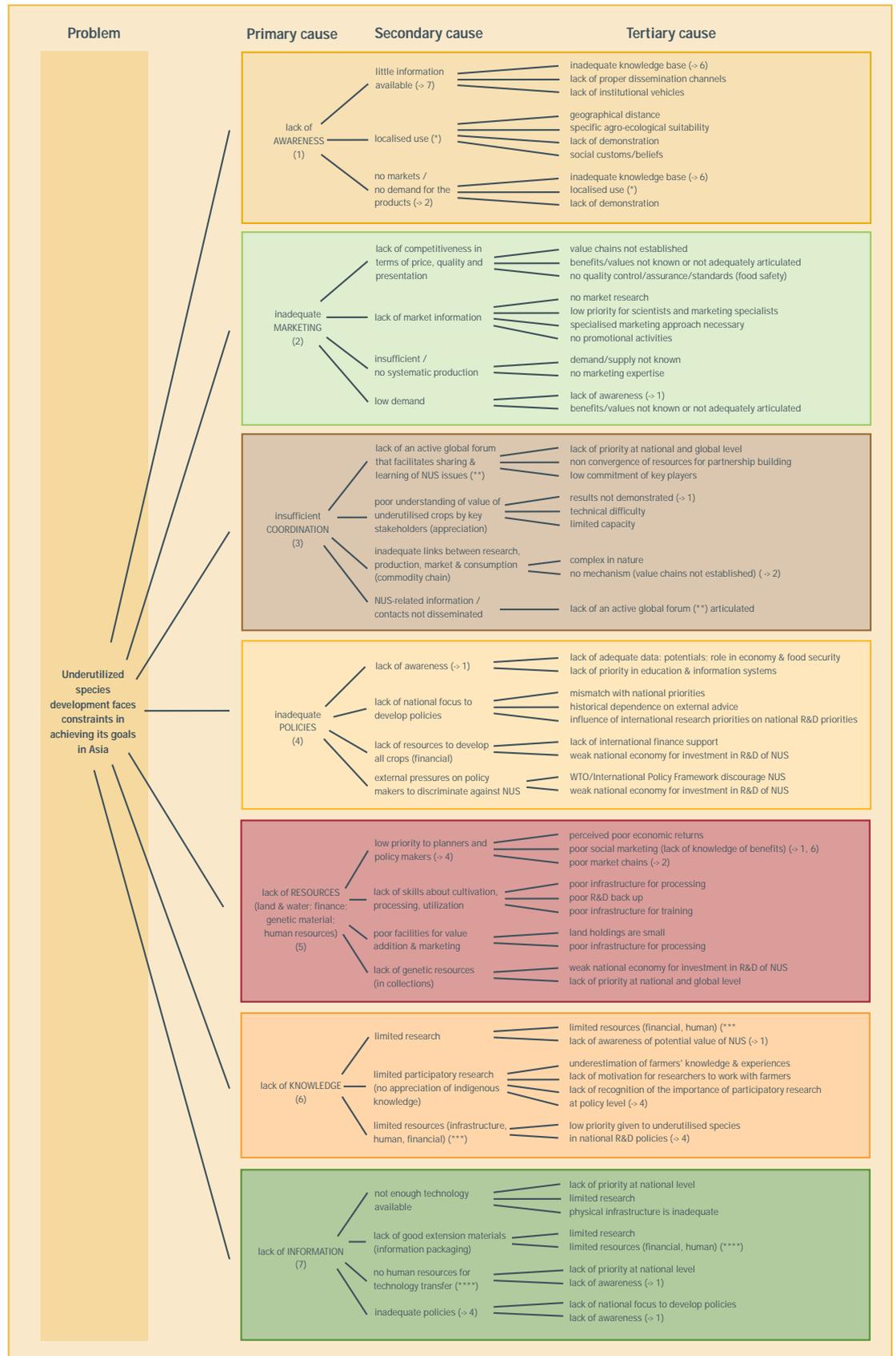
- GFAR Conference recommends involvement in underutilized crops (2000)
- PROTA Foundation created (2000)



*Increasingly, high-end consumers – such as urban supermarket shoppers – appreciate the availability of traditional fruits and vegetables.*

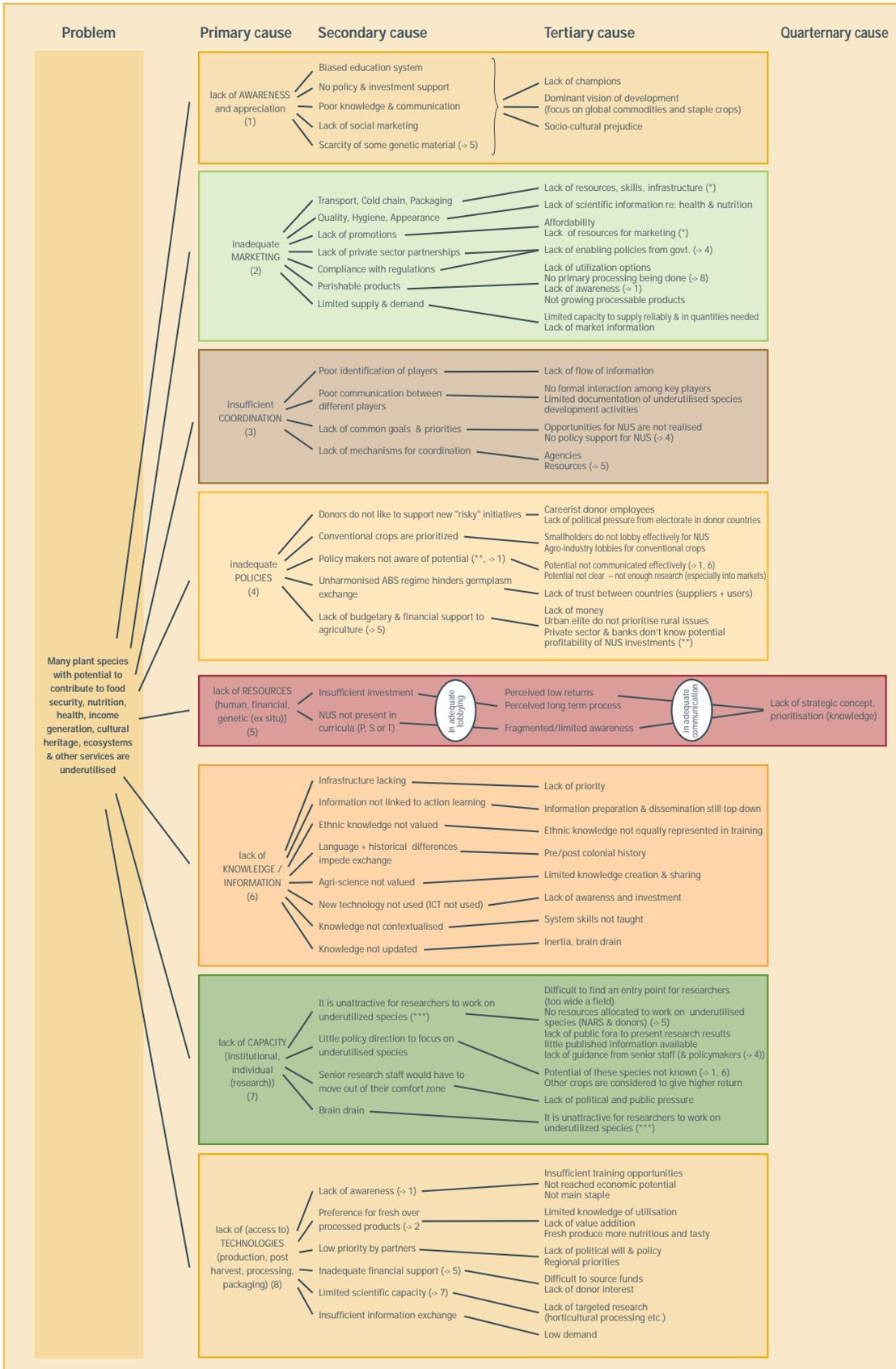
- Major global project on Neglected and Underutilized Species launched (IFAD-IPGRI, 2001)
- AVRDC strategy to 2010 published (2001)
- FAO launches initiative on agro-biodiversity and HIV/AIDS (2001)
- Web sites dedicated to underutilized species created (ICUC, IPGRI-NUS, GFU, Purdue)
- Global Facilitation Unit for Underutilized Species established (2002)
- IPGRI NUS strategy published (2002)
- ICUC-IPGRI: Global Research on Underutilized Crops published (2002)
- GFU-InWEnt International workshop (2003) and follow-up consultation held (2004)
- ACUC established (2004)
- LEISA issue on underutilized crops published (2004)
- Recognition given by SBSTTA-CBD and CoP7 (2004)
- EU-FP6 specific call for underutilized plants made (2005)
- CGIAR priorities incorporate underutilized genetic resources (2005)
- USAID Horticultural Assessment conducted (2005)
- GFU-IPGRI-MSSRF Chennai Consultation for policy makers realized (2005)

# Annex 2a: Problem tree for activities with underutilized plants, Asia and the Pacific



Note: arrows and numbers in brackets (e.g. -> 1) indicate links to primary problems; asterisks indicate loops within problem areas.  
R&D = Research and development; NUS = Neglected and underutilized species

# Annex 2b: Problem tree for activities with underutilized plants, Sub-Saharan Africa



Note: arrows and numbers in brackets (e.g. -> 1) indicate links to primary problems; asterisks indicate loops within problem areas.  
 NUS = Neglected or underutilised species; P, S or T = Primary, secondary or tertiary education

# Annex 3: List of organizations and individuals involved in the consultation

We sincerely thank the following for their valuable feedback and support during the consultation process:

Izham Ahmad, TFNet, Malaysia  
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Arma Bertuso, PEDIGREA, Philippines  
Thomas Bernet, International Potato Center (CIP), Peru  
M. L. Chadha, The World Vegetable Center (AVRDC) - Hyderabad office, India  
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Josep Gari, FAO, Italy  
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Peter Griffee, Food and Agriculture Organization of the United Nations, Italy  
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Herat Gunasena, CARP, Sri Lanka  
Ameenah Gurib-Fakim, University of Mauritius  
Vu Manh Hai, Research Institute of Fruits and Vegetables (RIFAV), Vietnam  
Nazmul Haq, University of Southampton, United Kingdom  
N. G. Hegde, BAIF Development Research Foundation, India  
Catur Hemanto, Indonesian Fruit Research Institute  
Irmgard Höschle-Zeledon, Global Facilitation Unit for Underutilized Species, Italy  
Nguyen Quoc Hung, Research Institute of Fruits and Vegetables (RIFAV), Vietnam  
Hannah Jaenicke, International Centre for Underutilised Crops, Sri Lanka  
Julian Jaftha, Department of Agriculture, South Africa  
Ramni Jamnadass, ICRAF, Kenya  
Monty P. Jones, FARA, Ghana  
Antoine Kalinganire, ICRAF-Mali office  
Assétou Kanouté, ADAF/Gallé, Mali  
Ralph von Kaufmann, FARA, Ghana  
Faith Kirima, Family Concern, Kenya  
Caroline de Kock, Tulimara Pvt, Zimbabwe  
Froukje Kruijssen, IPGRI, Malaysia  
Gladman Kundhlande, SAFIRE, Zimbabwe  
M. Hashim Laghari, Ghafoor, Pakistan Agricultural Research Council (PARC), Pakistan  
Roger Leakey, James Cook University, Australia  
Ard Lengkeek, Royal Tropical Institute (KIT), The Netherlands  
M. M. Lewanika, National Institute for Scientific and Industrial Research, Zambia  
Bernhard Lühr, International Centre for Insect Physiology and Ecology, Kenya  
Patrick Maundu, IPGRI-Sub-Saharan Africa office, Kenya  
Subhash Mehta, Devarao Shivaram Trust, India  
Yasuyuki Morimoto, IPGRI-Sub-Saharan Africa office, Kenya  
Margaret Mukulo, Rural Outreach Programme, Kenya  
W. H. Ntundu, National Plant Genetic Resources Centre, Tanzania  
Omo Ohiokpehai, TSBF – CIAT, Kenya  
Elizabeth Omino, Plant Resources for Tropical Africa (PROTA), Kenya  
Ruth Oniang'o, Rural Outreach Programme, Kenya  
Stefano Padulosi, International Plant Genetic Resources Institute, Italy  
John Palmer, Natural Resources International Limited, United Kingdom  
Jim Pettipher, Green & Gold, United Kingdom  
Denzil Phillips Limited, United Kingdom  
Henry Phombeya, Land Resource Centre, Malawi  
Pierre du Plessis, CRIAA SA-DC, Namibia  
Vanaja Ramprasad, Green Foundation, India  
R. B. S. Rawat, ICIMOD, Nepal  
George Rothschild, consultant, UK  
Revathy Rugmini, International Network on Bamboo and Rattan (INBAR) India office  
Alan Quartermain, NARI, Papua Guinea  
Ram P Sah, NARC, Nepal  
Victor Galán Sauco, Instituto Canario de Investigaciones Agrarias (ICIA), Spain  
Sidi Sanyang, FARA, Ghana  
Deva Bhakta Shakya, Agro Enterprise Centre (AEC), Nepal  
Modibo Sidibe, IER, Mali  
Tony Simons, ICRAF, Kenya  
Songpol Somsri, Horticulture Research Institute, Thailand  
Denis J. Sonwa, Sustainable Tree Crops Programme, IITA, Nigeria  
Bhuwon Sthapit, IPGRI, Nepal  
Detlef Virchow, The World Vegetable Center (AVRDC) – Regional Center for Africa, Tanzania  
Raymond Vodouhe, IPGRI – West and Central Africa, Benin  
Roland Waardenburg, Ahold Sustainable Trade Development, the Netherlands and Ghana  
Mary Wabule, KARI, Kenya  
John M. Wasswa, NARO, Uganda  
Shanthi Wilson Wijeratnam, Industrial Technology Institute (ITI), Sri Lanka  
Ahmad Zahoor, Pakistan Agricultural Research Council (PARC), Pakistan  
Zongwen Zhang, IPGRI, China  
Jinaderie de Zoysa, HORDI, Sri Lanka

## Annex 4: Ongoing activities by some actors<sup>2</sup>

### Africa

The **Forum for Agricultural Research in Africa (FARA)** manages a number of relevant Africa-wide programmes, such as the Framework for African Agricultural Productivity (FAAP), the Sub-Saharan Challenge Program (SSA CP), Building African Scientific and Institutional Capacity (BASIC), Dissemination of New Agricultural Technologies (DONATA), Regional Agricultural Information and Learning Systems (RAILS), and Biotechnology and Biosafety.

**Tulimara, Zimbabwe** is a private limited company based in Harare. It focuses on commercialising underutilized species, such as indigenous beans, wild fruits, herbal tea and mopane worms. Tulimara adds value by processing these products into jams, canned products, teabags, cereal bars etc. They then market and sell these finished products locally, regionally and internationally. Tulimara is still only producing very small quantities because the lack of knowledge about the species they work with results in very low demand.

The **University of Mauritius** has been involved in the creation of a database on medicinal and aromatic plants; data on many plants have been published in the form of books, CD-ROMs, articles etc. The University also studies the bioactive components of medicinal plants; validates and valorises medicinal and aromatic plant extracts; and documents and publishes information on lesser known and underutilised plant resources. It recently published a book on *Lesser-known and underutilized plant resources* in English and French.

The **Sustainable Tree Crops Program (STCP)**, convened by the International Institute for Tropical Agriculture (IITA), Nigeria, is examining how underutilized species can be associated with perennial tree-crop systems (such as cocoa agroforests) in West and Central Africa. They are characterising the perennial tree-crop systems and are developing approaches to better introduce these species into existing agroforestry systems (or to include them during the establishment of new perennial tree-crop systems). STCP is producing scientific articles/reports, developing training materials and establishing demonstration plots in which underutilized species are associated with cocoa.

**SAFIRE (Southern Alliance for Indigenous Resources)**, Zimbabwe, promotes the use of underutilized crops for various purposes. It conducts research on processing of underutilized crops as nutritional supplements and for use by people with HIV/AIDS. SAFIRE also develops products for commercialisation by private-sector companies, as well as systems for managing the natural resource base from which these crops are harvested.

The **Institut d'Ecologie Rural (IER)**, Mali, is involved in the following activities:

- Collection and conservation of food, medical and forage underutilized plant species, and their genetic characterisation
- Research on propagation methods (seeds/vegetative materials)
- Silvicultural methods for these species
- Nutritional analysis of some products (i.e. baobab leaves and fruit)
- Adaptation trials for some species (i.e. adaptation of *Vepris* to lowland conditions)
- Processing and marketing of some products (baobab, tamarind, amaranth, mango, shea, etc.)

**ADAF/Gallé**, Mali, is a local NGO that supports women's grassroots organisations. The NGO is involved in agriculture, environment, savings and credit systems and microfinance. It also provides agricultural information and communication services (rural radio, farmer workshops, etc.), supports family planning, and is involved in promoting information, communication and education on HIV/AIDS. ADAF/Gallé also supports rural people in the establishment and maintenance of grain-cereal banks, and promotes social mobilisation around micro-projects, such as the building of small dams, bridges or vegetable gardens. ADAF/Gallé assists in the large-scale diffusion of improved crop varieties such as maize, NERICA rice, peanuts, etc.

<sup>2</sup> This list is based on individual contributions and is necessarily incomplete. However, it serves to provide some illustration of the variety and diversity of on-going initiatives.

## Annex 4: Ongoing activities by some actors continued...

### Asia and the Pacific

The **James Cook University, Australia** is focussing on the participatory domestication of *Canarium indicum* in Papua New Guinea and Solomon Islands; *Barringtonia procera* and *Inocarpus fagifer* in Solomon Islands; *Santalum austrocaledonicum* in Vanuatu; *Santalum lanceolatum* and *Morinda citrifolia* in Cape York, Far North Queensland.

The **Pakistan Agricultural Research Council (PARC)** has recently initiated research and development with underutilized crops. They have identified ten crops that will be covered under a development project, with an emphasis on indigenous landraces, and have collected germplasm for these crops. The germplasm collected has been added to their genebank for conservation under three different conditions. This germplasm is also being evaluated for various characteristics, for documentation and further utilization. Although PARC has limited staff and resources for this difficult task, the young researchers of the institute are enthusiastic and are involved in R&D work as well as other routine activities on plant genetic resources (PGR) that are mandatory within the PGR program. In addition, a national workshop was recently conducted to formulate strategies for R&D for underutilized crops.

The **Research Institute for Fruits and Vegetables, Vietnam (RIFAV)** has a breeding programme for the neglected and underutilized plants available in the country and introduced from the outside. It exchanges relevant information and materials and is involved in UTFANET and ACUC. RIFAV is involved in capacity building through cooperation projects within ICUC, with the assistance of international and regional organizations and national programmes.

The **Industrial Technology Institute, Sri Lanka (ITI)** was established to support industry and largely conducts applied research to develop and promote food industries. In the Food Technology Section, ITI provides troubleshooting and consultancy services, and assists industry – largely SMEs – with technology for processing and minimization of loss with fresh produce (raw material). With regard to underutilized plant species, ITI works with crops such as jackfruit (*Artocarpus heterophyllus*), breadfruit (*A. altissis*), rambutan (*Nephelium lappaceum*), beli (*Aegle*

*marmelos*), kirala (*Sonneratia caseolaris*), soursop (*Annona muricata*), wood apple (*Feronia limonia*), durian (*Durio zibethinus*), etc. ITI looks at loss reduction at the post-harvest level and processing for income generation. It should be noted, however, that although there are several crops – such as mango and papaya – that have been well researched in other countries, these have not really reached their potential as significant income-generating or food crops in Sri Lanka. Most fruits are expensive and unaffordable to many Sri Lankans, particularly those living in urban areas.

The **Agro Enterprise Centre, Nepal (AEC)** is the business development/promotion unit of the Federation of Nepalese Chambers of Commerce and Industry and was involved in the identification of underutilized fruits of significance in Nepal (lapsi (*Choerospondias axillaris*), bael (*Aegle marmelos*) and jackfruit). AEC was also involved in organizing groups, establishing resource centres and training groups in the collection and processing of products, and in marketing. This program was initiated under ICUC with DFID financial support.

The mandate of the **International Centre for Integrated Mountain Development (ICIMOD)** is poverty alleviation and environmental biodiversity conservation in mountain regions. ICIMOD is involved in ensuring improved economic security for mountain communities through appropriate and reliable market linkages and improved livelihoods, with a focus on traditional crops that have a bearing on ensuring natural, physical, financial and social capital amongst these communities.

The **Indonesian Fruit Research Institute (IFRURI)** focuses on germplasm collection; supply of seed and planting material; and participatory breeding, domestication and development for two commodities:

- breadfruit, as source of staple food (food security) in Eastern Indonesia (East Nusa Tenggara)
- sapota, as a potential source of income (income security) in Western Indonesia (Sumatra).

These two commodities were selected based on the sociocultural and agro-ecological zones of Indonesia.

The **Nepal Agricultural Research Council (NARC)** is involved in activities related to plant genetic

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resources, such as:

- Exploration, collection, conservation, characterization, regeneration, documentation and utilization
- Provision of policy support to the Ministry of Agriculture and Cooperatives (MoAC)
- Collaborative participatory research on NUS with IPGRI, Italy and MSSRF
- A limited R&D programme on buckwheat, finger-millet, oat, barley and minor legumes and oilseeds.

**BAIF Development Research Foundation**, India, is engaged in generating gainful employment for small and marginal farmers by facilitating the use of degraded natural resources in several parts of India. Promotion of tree-based farming on degraded lands is an important programme, through which farmers are provided with various inputs to establish fruit species and multipurpose tree species on their holdings.

Under this programme, the participating families are given the necessary guidance and critical inputs to establish fruit orchards on 0.4 ha. The major fruit crops, which are promoted on the basis of soil productivity, moisture availability, demand for the produce and economic returns, are mango, cashew, sapota and Indian gooseberry. Apart from the above crops, many other underutilized fruit-tree species have been introduced on a small scale, mainly on field borders and bunds, serving as windbreaks, and thereby contributing to income and food security. The inter-space is used by farmers for the cultivation of vegetables and food crops. These intercrops support families to a great extent during the gestation period. The families maintaining such orchards on 0.4 ha are able to earn over USD 500 per annum when the trees begin to bear, generally after five to six years. Thus, the programme has demonstrated the feasibility of promoting biodiversity and ecological restoration whilst ensuring sustainable livelihoods for the local communities.

Various underutilized fruits are being popularised under this programme, including custard apple (*Annona squamosa*), ber (*Zizyphus mauritiana*), tamarind (*Tamarindus indica*), jackfruit (*Artocarpus heterophyllus*) and Indian gooseberry (*Emblica officinalis*). The advantages of these crops are their ability to grow in harsh and adverse agroclimatic

conditions. The products of these species are consumed by local people and often considered delicacies. Many of these species have good nutritional and medicinal value. Efforts are now being made to process these fruits for value addition and establish close linkages amongst consumers and producers.

**The MS Swaminathan Research Foundation**, India, is working with farming communities in a participatory manner to promote the cultivation and consumption of underutilized crops, largely nutritious millets, so as to increase farmer income. They are using pathways such as participatory variety selection to increase yield; community conservation of traditional varieties; introduction of appropriate technology; community capacity building for value addition; product development; and marketing of value-added products to enhance income generation.

**The Secretariat of the Pacific Community (SPC)**, Fiji, coordinates the Pacific Agricultural Plant Genetic Resources Network, which links plant genetic resources programmes and scientists in the Pacific who are working on underutilized species such as taro, breadfruit, yams, pandanus and local fruits and nuts. SPC also maintains a regional in vitro conservation facility, the Regional Germplasm Centre, which conserves and distributes virus-free materials of important Pacific crops.

**PEDIGREA** (Participatory Enhancement of Diversity of Genetic Resources in Asia) is a Southeast Asian initiative that aims at strengthening the capacity of local communities to improve their own crop and animal germplasm, and to create a market for their community products. The project areas are in Indonesia (West Java), Philippines (Mindanao) and Cambodia. PEDIGREA focuses on rice, local vegetables and local farm-animal breeds; specifically, it works on underutilized crops such as *Benincasa hispida*, *Luffa cylindrica*, *Momordica charantia* and *Solanum melongena*. In this way, PEDIGREA works to contribute to food security, including improvement of diets, and to promote the in situ maintenance of genetic resources.

## Annex 4: Ongoing activities by some actors *continued...*

**The Papua New Guinea (PNG) National Agricultural Research Institute (NARI)** has the mandate to undertake research on food crops and minor or emerging cash crops, with a particular emphasis on providing assistance to smallholder farmers. Its mission is 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 rich biodiversity, which includes a wide range of neglected and underutilized species of plants for food and agriculture, both cultivated and gathered from the wild. Some of the latter are suitable for domestication; this is the focus, for example, of the NARI's current research on *Canarium* nuts. The current research portfolio includes work on genetic resources, breeding, and pests and diseases of the major staples – sweet potato, *Colocasia taro*, banana and several species of yam – as well as rice, open-pollinated maize, peanuts and, for the neglected 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, 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 on soybeans. Research projects proposed in the NARI Strategic Programme Implementation Plan for the coming five years include post-harvest technology and downstream processing to expand demand; marketing studies, especially for staples; and work on sago, two species of *Pandanus* and several indigenous nut and fruit species. The Plant Genetic Resources Programme for the conservation, characterization, evaluation and utilization of the diversity within the main staples and traditional vegetable crops, such as aibika (*Abelmoschus manihot*) and the two species of pitpit (*Setaria palmifolia/Saccharum edule*), will continue to be active.

### **International**

The **International Plant Genetic Resources Institute (IPGRI)** has recently completed an IFAD-funded

project that represents the first truly global effort in support of neglected and underutilized species (NUS). Its focus was on Andean grains in Bolivia, Ecuador and Peru; nutritious millets in India and Nepal; and medicinal and aromatic plants in Egypt and Yemen. The Project covered a comprehensive spectrum of activities, including the collection and study of useful diversity, selection of better varieties, improvement of processing and value-adding methods, enhancement of supply chains, development of better policy frameworks and raising of public awareness. This participatory effort has helped to empower communities to gain access to an improved diversity of target crops, mobilize this diversity through strengthened local supply systems and improve supply chains that generate income for women and other community members.

IPGRI has also been successful in raising the profile of underutilized species by increasing publicity at high-level fora, such as the Convention for Biological Diversity (see 9th meeting of SBSTTA 2003 and [www.iisd.ca/biodiv/cop8/enbots/20mar.html](http://www.iisd.ca/biodiv/cop8/enbots/20mar.html)).

On behalf of the **CGIAR System-wide Genetic Resources Programme (SGRP)**, IPGRI has commissioned a study to survey the number of species and collections that are held in the CGIAR Centres' genebanks, as well as the level to which they have been characterized. The study will also revise the existing literature to identify cases where the use and conservation of underutilized species have or have not benefited the poor. Based on these results, IPGRI will make recommendations to SGRP and the CGIAR System as to how best to strategise their work on underutilized species for the benefit of the poor.

The **Global Facilitation Unit for Underutilized Species (GFU)** is a service provider to other actors in the field and has a strong advocacy role. Its activities are, therefore, focussed on providing information, connecting actors, and creating greater awareness of the role that underutilized species play in improving livelihoods, as well as on policy recommendations aimed at creating an enabling environment for wider use of underutilized species.

The **International Centre for Underutilised Crops (ICUC)** has supported national germplasm collections for a limited number of underutilized crops such as pummelo (*Citrus maxima*), jackfruit (*Artocarpus*

*heterophyllus*) and tamarind (*Tamarindus indica*). It has produced a series of monographs and extension materials on 10 priority species and has organised relevant training courses. It has also been instrumental in the creation of several dedicated regional networks (UTFANET, SEANUC, UTVAPNET and ACUC).

The **University of Nottingham, UK** has been associated with bambara groundnut for 17 years, with activities that cover the gamut from molecular research to marketing, in Africa, India and Europe. U Nottingham also conducts research on African yam bean and has a network of partners with experience in lupin, triticale and finger millet.

The **Centro Internacional de Agricultura Tropical (CIAT)** is involved in many activities related to research for development, ranging from biotechnology to social sciences. Recently, a new area of research is being implemented which is highly relevant to this consultation. CIAT now has a Tropical Fruits project and is developing activities with mainstream species as well as with species with strong local markets that by definition are considered underutilized. CIAT has several projects for the improvement of regional species, but the criterion to work on these species is that they have an established market.

**AVRDC-The World Vegetable Center** is the principal international centre dedicated to vegetable research and development. AVRDC develops varieties, such as the African eggplant, and technologies that increase vegetable production and consumption in developing countries. This leads to more economic opportunities, higher incomes and healthier diets for the poor.

The **U.N. Food and Agriculture Organization (FAO)** has long-standing work related to biodiversity for food and nutrition, including specific initiatives with underutilized plants and related indigenous knowledge. This work covers policy initiatives, pilot actions and publications aimed at catalysing the wide use of plant resources for food, nutrition and livelihoods. The FAO Commission on Genetic Resources for Food and Agriculture is the inter-governmental forum for genetic resources, with a notable focus on plant resources and underutilised species. Furthermore, FAO negotiated and hosts the International Treaty on Plant Genetic Resources, which is a global agreement that, amongst other goals,

endorses national and global efforts "promoting the expanded use of local and locally adapted crops, varieties and underutilised species" (art. 6.3). FAO has also an Interdepartmental Working Group on Biological Diversity, which coordinates research, awareness and development initiatives on plant resources, including underutilised species, from diverse approaches. Some of these initiatives highlight the nutritional value of less-known plants and cultivars, whilst others have raised awareness of the role of underutilised plant species in mitigating AIDS impact and in enhancing the livelihoods of rural and poor urban populations.



*National, regional and international collaboration can support researchers and farmers in the development of improved varieties, such as this taun (*Pometia pinnata*) in Papua Guinea.*



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**International Centre for  
Underutilised Crops (ICUC)**

P. O. Box 2075  
Colombo  
Sri Lanka

Tel: +94-11-2787404 ext. 3307  
Fax: +94-11-2786854  
Email: [icuc-iwmi@cgiar.org](mailto:icuc-iwmi@cgiar.org)  
[www.icuc-iwmi.org](http://www.icuc-iwmi.org)



**Global Facilitation Unit for  
Underutilized Species (GFU)**

Via dei Tre Denari, 472/a  
00057 Maccarese, Rome  
Italy

Tel: +39-06-6118292  
Fax: +39-06-61979661  
Email: [underutilized-species@cgiar.org](mailto:underutilized-species@cgiar.org)  
[www.underutilized-species.org](http://www.underutilized-species.org)



**International Plant Genetic  
Resources Institute (IPGRI)**

Via dei Tre Denari, 472/a  
00057 Maccarese, Rome  
Italy

Tel: +39-06-61181  
Fax: +39-06-61979661  
Email: [ipgri@cgiar.org](mailto:ipgri@cgiar.org)  
[www.ipgri.cgiar.org](http://www.ipgri.cgiar.org)