Hunger and poverty: the role of biodiversity

Edited by S. Bala Ravi, I. Hoeschle-Zeledon, M.S. Swaminathan, E. Frison

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Report of an International Consultation on The Role of Biodiversity in Achieving the UN Millennium Development Goal of Freedom from Hunger and Poverty
Chennai, India, April 18-19, 2005

Edited by S. Bala Ravi, I. Hoeschle-Zeledon, M.S. Swaminathan, E. Frison

Consultation organized by
M.S. Swaminathan Research Foundation (MSSRF)
International Plant Genetic Resources Institute (IPGRI)
Global Facilitation Unit for Underutilized Species (GFU)

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Published by

M.S. Swaminathan Research Foundation, Third Cross Road, Taramani Institutional Area, Chennai 600 113, India
International Plant Genetic Resources Institute, Via dei Tre Denari 472/a, 00057 Maccarese (Fiumicino), Rome, Italy
Global Facilitation Unit for Underutilized Species, Via dei Tre Denari 472/a, 00057 Maccarese (Fiumicino), Rome, Italy

ISBN-13: 978-92-9043-703-1
ISBN-10: 92-9043-703-0

Photographs by courtesy of Dr S. Bala Ravi, MSSRF, Chennai, India

Printed at AMM Prints, No. 1, Elimnagar, Second Main Road, Perumkudi, Chennai 600 096, India.

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*This paper was not presented during the Consultation but was distributed to participants

FOREWORD

Agricultural biodiversity plays a central role in household food security and income generation, and thus in achieving Millennium Development Goal (MDG) 1 of halving the proportion of hungry and extremely poor people by 2015. However, its wider use to address nutritional deficiencies and other aspects of poverty, all of paramount importance, is yet to be fully realized.

With this in mind, an International Consultation was held in Chennai, India, in April 2005, gathering together policy-makers and experts with diverse backgrounds from 25 countries. The aim of the Chennai consultation was to emphasize the unique contribution that agricultural biodiversity makes to improved livelihoods, through providing a foundation for household food and nutrition security and offering opportunities for income generation. Agriculture is what feeds us but agricultural biodiversity is what sustains us. The consultation also looked at policies, institutional constraints and other issues that are impeding the full deployment of these natural resources and hence limiting the achievement of the MDGs. Concern was registered at the rapid loss of these resources, which seriously threatens the food and nutrition security of future generations.

This report documents the presentations made at the consultation and the papers contributed, the discussions conducted thereon, the outputs of the working groups and the final recommendations.

The principal outcome of the consultation was the adoption of the Chennai Platform for Action, which was drawn up with serious commitment on the part of all present to address the value of agricultural biodiversity in meeting the MDGs. This is a 10-point strategy, designed to assist national governments and international agencies to achieve, as soon as possible, the UN MDG of halving extreme poverty and hunger by 2015. This can be done through the promotion of local, community-centered systems that will deliver improved food security and health, based on the cultivation of a wide range of food crops, vegetables, fruits and medicinal plants. The Chennai Platform for Action is available as a separate publication in seven languages to facilitate action and awareness generation by different stakeholders.

It is hoped that this action plan will be widely adopted because the eradication - and not mere reduction - of hunger and poverty must become an overriding priority for public action and investment. Moreover, the challenge of the MDGs is not simply to halve hunger but also to attack the hidden hunger caused by unbalanced diets, and to do so in a sustainable manner. In the past, approaches to hidden hunger were essentially based on supplementation and fortification. However, such remedies do not address all aspects of malnutrition and have not proved feasible in all circumstances, particularly for the rural poor. Therefore, the dietary diversity approach is really the main way forward. We must bear in mind that the right to food is the right to 'good' or 'adequate' food.

The global struggle against poverty and hunger cannot be won without increased collaboration in the conservation, and sustainable and fair use of agricultural

biodiversity. Genetic diversity is the foundation of all improvements to agriculture. Diversity can also help improve productivity by raising yield stability, contributing to pest and disease control, and improving the environment.

Meeting the Millennium Development Goals will require political will, financial commitment and a readiness to attempt innovative solutions. The very fact that five years after the adoption of these goals, most developing countries have been unable to make proportionate progress in the elimination of hunger and poverty indicates the need for an overall change in the manner in which we have addressed this challenge to date. Without such a change we will not achieve the goal of a hunger-free world.

Let us keep before our eyes a positive reality: that, given the necessary resources and collaboration, the MDGs *can*, in fact, be achieved.

In a world where 852 million people are hungry, in the words of FAO Director-General, Jacques Diouf, "The question is not whether we can afford to take the urgent and immediate action needed … The question is whether we can afford not to.[1]" Can we have a hunger-free world? This is the challenge.

Emile Frison
Director General, IPGRI

Olanrewaju Smith
Executive Secretary, GFAR

M.S. Swaminathan
Chairman, MSSRF

[1]The State of Food Insecurity in the World 2004, FAO, Rome, 2004.

INTRODUCTION

An international consultation on the role of plant biodiversity in achieving the United Nations Millennium Development Goal (MDG) of Reducing Hunger and Poverty was held at the M.S. Swaminathan Research Foundation (MSSRF) in Chennai, India, on April 18 and 19, 2005. The consultation was organized jointly by the MSSRF, the International Plant Genetic Resources Institute (IPGRI) and the Global Facilitation Unit for Underutilized Species (GFU). More than 100 policy-makers, planners, agricultural scientists, nutritionists, donor representatives, farmer representatives, the international media and non-governmental organizations attended the consultation. The initiative was sponsored by the Swiss Agency for Development and Cooperation (SDC), the Canadian International Development Agency (CIDA), the International Fund for Agricultural Development (IFAD), the Syngenta Foundation and the Ford Foundation.

Taking part in the inaugural session on April 18 were the Ministers of Agriculture of Sri Lanka, Ghana and Kenya, the Minister of Agriculture of Tamil Nadu, the Director General of IPGRI, representatives of IFAD, SDC and the Syngenta Foundation, FAO, the German Technical Cooperation (GTZ), the Global Forum for Agricultural Research (GFAR), the Italian Academy of Sciences, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), members of the diplomatic corps, delegates, invitees of other stakeholders, and the media.

The organizers aimed at providing useful inputs on how plant biodiversity can improve people's livelihoods and thereby help reduce hunger and poverty, for presentation at the September 2005 meeting of the United Nations Millennium Assembly.

The invitation sent out to participants outlined the background to the consultation and its objectives. It pointed out that while humankind has used more than 7,000 plant species for food purposes, agricultural research has concentrated on very few of these species. Over half of the protein and food energy we consume is now met by three crops only: maize, wheat and rice. The narrowing base of global food and nutrition security limits people's livelihood options, particularly for those living in developing countries. While major crops and commodities receive considerable attention in national and international agricultural research and development policies, other crops and species are largely ignored and their sustainable conservation and use is in jeopardy.

To achieve the MDG on extreme poverty and hunger, policy-makers must pay greater attention to the cultivation and use of plant biodiversity, including locally-important crops, such as millets, legumes, leafy vegetables, tubers, fruits and medicinal and aromatic plants. Efforts are needed to improve capacity building in plant biodiversity conservation and use of technologies, services and public policies, particularly those related to pricing and marketing. The consultation aimed to contribute to these efforts**.** It wanted to assist the international community in demonstrating ways to better deploy plant biodiversity to address these major goals, and recommend actions to be taken by national and international organizations.

The invitation indicated that recommendations adopted by the consultation would form the basis of a document to be presented to the September meeting of the UN Assembly, scheduled to review the progress on MDGs. The document would present an overall assessment of progress achieved so far in meeting MDG 1 through the use of plant biodiversity and suggest actions to move this agenda forward over the next five years. The role of stakeholders (policy-makers, researchers, farmers, donors, media and consumers) would also be addressed by the recommendations. The final document would be made available in all six UN languages (Arabic, Chinese, English, French, Russian and Spanish), and in Italian.

INAUGURAL SESSION

Chair: Prof M.S. Swaminathan, Chairman, National Commission on Farmers, India

The inaugural session began with an invocation by Ms Anuradha Krishnamurthy, distinguished interpreter of Carnatic music, who recited two Tamil lyrics composed by Subramania Bharati and Chandrasekhara Saraswati.

This was followed by a short film entitled '*We shall overcome*'. The film focused on the post-tsunami livelihood-rebuilding activities initiated by the MSSRF in coastal Tamil Nadu.

Welcoming Addresses

Dr M. Velayutham, Executive Director, MSSRF, welcomed the dignitaries and participants to the M.S. Swaminathan Research Foundation and to the consultation. He mentioned that India has two of the 12 mega-biodiversity centers of the world, and that Indian culture and nature have intertwined down through the ages. He recalled an episode from an ancient Indian scripture, to highlight the importance attributed to every element of biodiversity. According to this, a learned saint asked one of his disciples to bring him a plant "that is useless". After a long search, the exasperated disciple came back to inform the saint *guru* that he couldn't find a useless plant.

A glimpse of the high table, with The Hon E. Debrah, Minister for Agriculture, Ghana; the Hon A.K. Dissanayake, Minister of Agriculture, Sri Lanka; the Hon M. Akaranga, Assistant Minister of Agriculture, Kenya; and Prof M.S. Swaminathan, Chairman, MSSRF.

Dr Velayutham said that soon after India had become a signatory to the 1992 Convention on Biological Diversity (CBD), MSSRF organized a series of national consultations.[2] These consultations, as well as MSSRF's public advocacy, resulted in two pieces of legislation enacted by the Government of India: the Protection of Plant Varieties and Farmers' Rights Act, 2001 and the Biological Diversity Act, 2002.

With the institution of the National Biodiversity Authority, the government of India has made the Biological Diversity Act operational. The Protection of Plant Varieties and Farmers' Rights Act is to be enforced very soon. In synchronization with this, MSSRF has initiated programmes to spread legal and genetic literacy through

[2] See "Farmers' Rights and Plant Genetic Resources Recognition and Reward," 1995; and "Agro-biodiversity and Farmers' Rights," 1996; both edited by Prof Swaminathan.

a number of promotional efforts, such as genome clubs in schools and colleges, and capacity building of rural and tribal communities for developing peoples' biodiversity registers, which will constitute the database on local biodiversity.

MSSRF action research on biodiversity at three sites, Wayanad in Kerala, Kolli Hills in Tamil Nadu and Jeypore in Orissa, has focused on the conservation and cultivation of neglected and under-utilized crops, medicinal plants, value additions and market linkages on these crops for enhancing livelihood opportunities to the rural poor and reducing poverty. The Scarassia Mugnossa Community Gene Bank, established at MSSRF in 1994 with support from the Government of Italy and from the SDC, has resulted in benefits for primary rural and tribal conservers, and reward and recognition for a community that had been for too long "unnoticed, unsung and unhonoured."

Dr Velayutham then read out a message received from the Prime Minister of India wishing the consultation success. The message was as follows:

I am happy that an international consultation is being held to develop an action plan for promoting local level community-centered food and health security systems based on the cultivation of a wide range of food crops – vegetables, fruits and medicinal plants. I hope that the action plan developed at this consultation will be widely adopted, since the eradication of hunger and poverty must receive over-riding priority in public action and investment. Every child, woman and man must have the opportunity for a productive and healthy life. This will be possible only if we integrate frontier science and technology with traditional wisdom and associated cropping patterns.

Dr K. Atta-Krah, Deputy Director General, IPGRI, welcomed the participants on behalf of IPGRI. He said that people concerned with genetic resources and biodiversity should strive to broaden their understanding of the subject. He shared with participants the fact that he himself had become passionate about biodiversity only after joining IPGRI and that he had not been aware of this 'tool' during his earlier work in agriculture. He recalled with pleasure two powerful keynote addresses on biodiversity given by Prof Swaminathan at the World Summit on Sustainable Development in Johannesburg and at the World Agro-Forestry Congress in Orlando, Florida.

Dr Atta-Krah said that IPGRI is one of 15 Future Harvest Centres supported by the Consultative Group on International Agricultural Research (CGIAR), which strives to mobilize cutting-edge science to reduce hunger and poverty, improve human nutrition and health, and protect the environment. Agricultural biodiversity is the major focus of IPGRI's mandate. Its work has evolved from an almost exclusive focus, at the start, on the collection and conservation of germplasm, to the present focus on the management of diversity and its use in addressing contemporary development challenges - especially those of food and nutrition security, poverty alleviation and environmental health.

IPGRI has recently embarked on a new strategy, which has four main programmes as its corner- stone. These are: diversity for livelihoods; understanding and managing biodiversity; commodities for livelihoods, and global partnerships. Dr Atta-Krah explained that IPGRI has no laboratories or field sites of its own. "We work with partners, leveraging our funds and expertise. We seek two kinds of outcomes from all our collaboration; the results of the research itself and the enhanced ability of all concerned to contribute to such efforts in the future. Partnerships are the key to our

operations. Our ambition is to remain a significant player in global efforts to make more effective use of agricultural biodiversity for development, using our special strength in plant genetic resources as the platform for extending into other areas of innovative research."

The key words for follow-up on the recommendations expected to emerge from the consultation are 'significance' and 'purpose', affirmed Dr Atta-Krah. They should lead to action along the development pathway.

Dr O. Smith, Executive Secretary, Global Forum on Agricultural Research (GFAR) also extended a warm welcome to dignitaries and participants on behalf of GFAR and explained that his organization is a forum to promote partnerships among all stakeholders in agricultural research for development. He pointed out that although some 7, 000 plant species can contribute to our food security needs, only 30 of these actually feed the world, contributing to 95% of our dietary energy needs. Furthermore, only three out of the 30 - wheat, rice and maize - have received all the attention in terms of investment and effort in conservation and improvement. These three crops today provide more than 50% of global plant-derived energy intake. Others, such as cassava, sorghum, millet, beans and plantain, that serve as staples in different regions or countries, also contribute to the global plant-derived energy intake, but to a lesser extent.

Dr Smith noted that a similar trend of concentration on limited components of available biodiversity is also true of genetic resources in livestock, aquatic and forest products. According to FAO statistics, only 30 of the 50,000 known mammalian and bird species have been utilized extensively to produce food; and only 15 species currently account for over 90% of the global livestock production.

The large group of "minor crops", also often referred to as 'under-utilised species', 'orphaned crops', 'neglected species', and so on, found in all regions of the world, are rich sources of energy, proteins and micro-nutrients, and can help fight hunger and also 'hidden' hunger, Dr Smith added.

GFAR recognized the important role such crops could play in meeting local and regional food security and poverty alleviation goals. In 2000, the forum decided to develop a Global Partnership Programme relating to under-utilized crop species, managed by a unit based in IPGRI. The programme highlights these crops and the communities that tap them. It urges scientists and policy- makers alike to move these crops from their present realm of neglect into mainstream biodiversity, so that they can promote the common goals of reducing poverty and malnourishment.

Presidential Address on 'Biodiversity and Millennium Development Goals', by Prof M.S. Swaminathan, Chairman, National Commission on Farmers, India, and Chairman, MSSRF

In his address on 'Biodiversity and Millennium Development Goals', Prof Swaminathan he called for action in helping to meet the first of the UN MDGs, on which the Conference was focused: freedom from extreme poverty and hunger. He

argued that the first among the goals, the 'eradication of extreme poverty and hunger by half by 2015', is a "common minimum agenda", which is "very modest". "If we cannot accomplish even this modest minimum goal, the world may run the risk of being judged as forgetting its humanity", said Prof Swaminathan. He reminded all that even after this agenda is met, 500 million people would still be hungry.

A recent global hunger map produced by FAO shows Sub-Saharan Africa and South Asia, including India, as the hunger hot-spots of the world. A series of task forces coordinated by Dr Jeffrey Sachs of the Earth Institute have been set up to help develop a strategy for achieving the MDGs. A Task Force on Hunger co-chaired by Prof Swaminathan and Dr Pedro Sanchez has assessed that halving extreme poverty and hunger by 2015 *is* possible with the implementation of the seven basic and important steps recommended by this Task Force. In summary, these seven steps are:

(i) Move from political commitment to action; (ii) Reform policies and create an enabling environment; (iii) Increase the agricultural productivity of food-insecure farmers; (iv) Improve nutrition for the chronically hungry and vulnerable; (v) Reduce vulnerability of the acutely hungry through productive safety nets; (vi) Increase incomes and make markets work for the poor; and (vii) Restore and conserve the natural resources essential for food security.

The consultation had already been told of the world's shrinking food basket, dominated by only four-to-five crops. Global food crop production in 2002 indicated that wheat, maize, rice and potatoes had achieved the highest production figures of the year. If any of these crops were to have a major setback, such as a deadly and widespread new pest or disease, everyone would be in a serious plight.

Prof Swaminathan mentioned a series of books on *'Lost crops'* published by the United States National Academy of Sciences, with interesting information on the crops grown in the past, their value for food and health security and their nutrition components, particularly iron, iodine, calcium, and manganese. In fact, an ongoing MSSRF project on 'Re-vitalization of neglected nutritious millets towards the food and income security of the rural poor' supported by IFAD, seeks to strengthen food security by restoring and reviving ancient traditions and crop varieties. It is one of the intentions of the Chennai consultation to revive and revitalize these earlier traditions in terms of food and health. Prof Swaminathan commented that some of these under-utilized crops have been given names with a mindset that ignores their nutritional value. He gave as an example the term 'coarse cereal' currently in use, stressing that these grains are rich in iron, calcium, phosphorus and certain vitamins. He urged FAO to change these negative terminologies to 'nutritionally important grains'.

Nutrition must be mainstreamed into all farming systems, stressed Prof Swaminathan, particularly in arid, semi-arid and hunger hot-spot areas. The biodiversity projects being implemented right now by MSSRF are helping to revitalize a large number of earlier cropping systems, and crop-related socio-cultural value systems with an integrated approach to benefit human, animal and soil health.

Prof Swaminathan highlighted the MSSRF pathway to achieving agro-biodiversity and sustainable nutrition and health security, which is a four-pronged process involving participatory conservation of local land races by the communities;

enhancement of genetic diversity through participatory plant breeding; promotion of the cultivation of farmers' varieties through community-managed gene-seed banks; and prevention of hunger by making grains available locally through community grain banks. The gene management system at MSSRF gives importance to community conservation with capacity building, value addition, and market linkages underscoring distributive and gender equity.

On the issue of intellectual property rights, Prof Swaminathan pointed out the importance of community rights, stating that they are just as important as individual rights - patents, plant breeders' rights, etc. The farmers' right is a community intellectual property right and needs to co-exist with individual intellectual property rights. Farm families, particularly women, have conserved ecological, economic and spiritual keystone species for different agro-ecosystems, and promotion of such community conservation is vital for the sustainability of biodiversity and the food and nutrition security it can provide.

Prof Swaminathan concluded his presidential address with some suggestions for an action plan that was expected to emerge from the consultation. *First*, launch an agro-biodiversity conservation movement and promote food-based nutrition literacy through participatory knowledge management and enhanced productivity and profitability of under-utilized crops. *Second*, link farming systems with functioning market chains to promote the concept of 'diversified diets for productive lives', *Third*, generate opportunities for skilled non-farm employment to resource poor farmers in hunger hot-spots, in post-harvest value addition and agro-processing with a bottom-up approach, involving in particular nutritious but neglected and under-utilized crops. *Fourth*, include a wide range of crops in nutrition support and safety net programmes with human development goals. *Fifth*, engender all nutrition support and farming systems programmes, giving priority to children of 0-5 years and to pregnant women. *Sixth*, promote nutrition gardens in schools, nutrition literacy and well-designed urban nutrition support programmes. *Seventh*, promote community food and nutrition security systems based on field gene-seed-grain banks, to redress endemic, hidden and transient hunger. And last, respecting the national sovereignty on biodiversity, promote greater international collaboration for its conservation and sustainable and equitable use so that biodiversity for hunger and poverty elimination could provide a platform for partnership among all the stakeholders involved in this "greatest living industry on our Planet".

He hoped that the action plan emerging from this consultation would be affordable and actionable, and would help to achieve over and above the MDG of halving hunger and poverty by 2015.

Special Address on 'Biodiversity and livelihoods', by Dr E. Frison, Director General, IPGRI

In his special address on 'Biodiversity and Livelihoods,' Dr Frison said that "we are not just talking about crops or animals themselves, which are the managed components of biodiversity, but also about unmanaged components, such as

pollinators and microbes. Diversity occurs at different levels in different ecosystems and environments. It is the diversity that exists within those species that allows us to improve crops or let farmers select more productive crops and animals. Agriculture is what feeds us but agricultural biodiversity is what sustains us." The contribution of biodiversity went beyond food production. Ecosystem services on earth are thrice the value of agricultural production; this fact was neglected in the economic evaluation of biodiversity work. Genetic diversity is the foundation of all improvements to agriculture. Diversity can also help improve productivity by raising yield stability, pest and disease control, and sustainability.

Dr Frison pointed out that agricultural production fluctuates from year to year due to climatic conditions, among other causes, but the shocks inflicted by drought, floods or civil strikes cause a sudden and steep drop in production. However, the more diverse the production system, the greater the resistance to shock, the resilience and capacity to return to normality, and the shorter the rebuilding time. This is very important, especially in marginal areas where farmers cannot afford to lose a crop. The primary goal is not maximizing productivity but minimizing risk. The wise use of diversity in these production systems is very important.

During a recent trip to China, Dr Frison discovered that work there on the use of resistant hybrids inter-cropped with traditional susceptible landraces of rice enabled the re-introduction of traditional varieties. These were superior, not merely nutritionally but culturally as well, because they were used for certain popular dishes. The Chinese experience also confirmed that even in modern agricultural production systems, greater biodiversity meant lower pesticide use and higher productivity.

"We know that biodiversity can deliver", asserted Dr Frison. "Biodiversity is not just a question of traits, however important that may be. We should use diversity in the production systems of today, to increase productivity and to produce a model of intensification for marginal areas, where the people's main concern is to minimize risks". Dr Frison said that IPGRI has proposed the setting up of a facilitation unit for agro-biodiversity, similar to the one for under-utilized species, introduced at the Conference of the Parties of the Convention on Biological Diversity.

Some examples from China show how partnerships between farmers, local extension agents, the private sector and researchers have made it possible for farmers and communities to have significant increases in income through better use of buck wheat, with training on improved seed production and the processing of that grain into flour.

With supporting statistics on hunger, Dr Frison stressed that the percentage of hungry people had diminished but that the world's increased population meant that 850 million people go to bed hungry every night. In the case of hidden hunger, one out of every three persons on this planet is affected. More than two billion people are affected by some degree of hidden hunger and malnutrition, caused by micronutrient deficiencies and imbalanced diets in general. Women and children are the main victims of hidden hunger.

It is not merely a question of old problems, such as Vitamin A deficiency or iron deficiency; it is also the increasing incidence, in developing countries, of the so-called 'diseases of affluence', such as cardiovascular disease, diabetes and

cancer, particularly in the urban areas, all linked to simplified diets providing more carbohydrates and fats. A greater thrust on biodiversity would help to prevent this phenomenon.

In the past, approaches to hidden hunger were made mainly through supplementation and fortification. Supplementation helped in some cases: for example, iodized salt has been a tremendous success in fighting goiter. But this remedy is not always possible, particularly for the rural poor. So the dietary diversity approach is really the main way forward.

We must focus on neglected and under-utilized species, traditional crops and varieties. We must improve their cultivation and look at the entire cycle of production, marketing and consumption.

We know that biodiversity conservation and nutrition health status are interrelated, as are also socio-cultural traditions and income generation. Greater use of biodiversity can give rise to a number of 'virtuous circles'. Higher incomes lead to better health which, in turn, improves the conservation of socio-cultural traditions along with biodiversity. This approach would engender a whole new dynamic in production systems that will be self-sustainable.

In conclusion, Dr Frison stated that agricultural biodiversity is most critical for human well-being, not only from the nutrition stand point but also with regard to health, shelter, water, environment and the sustainability of production systems. The Chennai consultation should come up with a positive message about what can and should be done through pooling of efforts. The consultation participants could thereby make a difference. The message from this consultation should feed into the forthcoming UN Assembly assessments in September of this year, regarding the progress made to date towards achieving the MDGs, and draw the attention of decision-makers to the critical role of agro-biodiversity in this endeavour. Dr Frison affirmed that given the necessary resources and collaboration, the MDGs could be achieved. Quoting Prof Swaminathan, he said that the right to food has to become the right to 'good' food.

Keynote Address on 'The role of plant biodiversity in achieving the Millennium Development Goals' , by Dr R.D. Cooke, Director, Technical Advisory Division, IFAD

In delivering the first keynote address, Dr Cooke expressed concern over the declining donor support for agriculture. He said that this support had fallen from 20 per cent in the 1980s to some 10-12 per cent at present. He asked how the importance of agricultural biodiversity can be enhanced when domestic budgetary allocations for agriculture itself have declined so sharply.

"Three quarters of the 1.1 billion people living in extreme poverty are in rural areas", said Dr Cooke, "and most make their living directly or indirectly from agriculture. Often, these people hold the frontlines against bio-diversity loss, desertification and natural resource degradation. They are the stewards of our

natural resources; they help to translate local efforts in combating poverty into global environmental benefits". Household food security for these poor people depends on a variety of crops. Many of these species occupy important niches and are adapted to the risky and fragile conditions of rural communities. This critical linkage between biodiversity and rural hunger is not, however, adequately recognised by the international R & D community.

Dr Cooke highlighted two important aspects of biodiversity: biodiversity and farming systems, and biodiversity for food and nutrition. With regard to the former, he stressed the fact that rural poverty alleviation efforts need to address the increasing competition for natural resources. This will require a broader portfolio of crops to meet diverse environmental conditions and new markets. A wide range of neglected crop species is already in the hands of the rural poor, and is being used on a regular basis to meet household needs. These crops have a comparative advantage in marginal lands, where they withstand conditions of stress and contribute to sustainable production with low-cost inputs. They thereby enrich diversity and strengthen the stability of agro-ecosystems.

These species have a strategic place in fragile ecosystems, such as arid and semi-arid lands, mountains, steppes and tropical forests. However, such locally important species are frequently under-utilised, both in household consumption and economic terms. Such neglect places them in danger of continuing genetic erosion, further restricting development options for the rural poor.

Agricultural biological diversity has long been recognized by IFAD as a gateway to empower rural people to overcome their poverty. A number of IFAD grant-financed programmes, potentially feeding into loan-financed projects, have helped to identify and diversify market opportunities for those minor crops on which the poor rely, and have supported the development of commodity chains likely to enhance genetic diversity by increasing the demand and use of under-utilised species. In this context, Dr Cooke cited the example of current IPGRI-coordinated projects on under-utilized species financed by IFAD.

Coming to the latter aspect, 'Biodiversity for Food and Nutrition', Dr Cooke recalled IFAD's active involvement in the cross-cutting initiatives on biodiversity for food and nutrition, organized in cooperation with FAO and IPGRI, under the Convention on Biological Diversity. He stated that these initiatives are intended to promote biodiversity by counteracting the simplification of diets, agricultural systems and ecosystems, and the erosion of traditional food cultures.

A diversity of foods derived from plants and animals remains the preferred choice for human health. Traditional food systems provide positive synergies between human and ecosystem health, while culture offers an essential context for positive dietary choices.

"We have here a community of like-minded people," said Dr Cooke. "We are convinced that agricultural biodiversity is important both for sustainable farming systems and for food and nutrition." But the move from political commitment to action and the creation of an enabling environment is possible only if national governments accord priority to agricultural biodiversity. This is not the case now.

Rodney D. Cooke, Director, Technical Advisory Division, IFAD, during a session break, talking to Kwesi Atta-Krah, Deputy Director General, IPGRI; Andrew Bennett, Executive Director, Syngenta Foundation; and Ruth Oniang'o, Founder, Rural Outreach Program and Member of Parliament, Kenya.

Scientists will therefore have to convince governments about what agricultural biodiversity can do to strengthen economic development and reduce poverty.

Keynote Address by The Hon K. Pandurangan, Minister of Agriculture, Tamil Nadu, India

The Hon K. Pandurangan commenced his keynote address by conveying the good wishes of the Tamil Nadu Chief Minister, Dr J. Jayalalithaa, to all present.

Minister Pandurangan said that agro-biodiversity provides environmental, and food and livelihood security to all. It has been nurtured for over 12,000 years by the knowledge and skills of both tribal and rural women and men farmers. However, now only 30 out of 7,000 edible plant species domesticated across our agricultural history meet 95 per cent of the world's food requirements. The extinction of crops and landraces and the consequent shrinking of the food basket has affected the food and nutrition security of the poor. Globally, more than 800 million people suffer from calorie under-nutrition, while over two billion suffer from hidden hunger resulting from dietary micro-nutrient deficiency.

The Minister said that rice, wheat and maize provide more than half of the world's food requirements. Small millets had been playing an important role in the food security of rural and tribal communities in Tamil Nadu. These are durable crops and are traditionally important for the anti-natal care of poor women. This has led to the creation and conservation of a great diversity of small millets in several parts of the Eastern Ghats.

However, many small millets have been disappearing in recent times. Processing technologies and market linkages have made commercial crops attractive and in fact they have replaced small millets. During the last half century, the area under small millet cultivation declined considerably in the Kolli Hills of the Eastern Ghats. Some of the major reasons for this transition are low productivity, lack of market channels and linkages, and the availability of high-yielding varieties of commercial crops.

The Minister called for a better understanding of the merits of plant diversity vis-à-vis the livelihoods of the poor; for action to overcome institutional constraints in using biodiversity; for stronger commitment from policy-makers and donors to support agricultural biodiversity; and for an enlargement of the food basket with a wide range of millets, oilseeds, pulses, vegetables and tuber crops, to eliminate under-nutrition, malnutrition and hidden hunger.

He congratulated MSSRF for promoting community grain banks to store and share locally-produced grains, and desired that the area under millets be increased.

Minister Pandurangan concluded his presentation by providing an outline of several schemes that his Chief Minister is putting in place to help the farming community in Tamil Nadu.

Inaugural Address by The Hon E. Debrah, Minister for Food and Agriculture, Ghana

The Hon E. Debrah, Minister for Food and Agriculture, Ghana, began his inaugural address by conveying the greetings of his government and people. He said the Millennium Development Goals confronted developing countries with the challenge of reducing the magnitude of extreme poverty by 2015. His country had developed the Ghana Poverty Reduction Strategy to set up structures for managing the economy and for building strong partnerships to meet this challenge.

The Minister stated that 95% of Ghana's rural population, or 65% of the national population, is engaged in agriculture. Flora and fauna have evolved over thousands of years in a dynamic interaction between nature and farmers, and this biodiversity provides many benefits, such as nutrition, medicine, the genetic base for crop improvement and environmental sustainability. Crop diversity is needed to overcome major farming constraints, such as pests, diseases, weeds, drought and poor soils. Gene banks are needed to protect crop diversity.

Minister Debrah hailed the efforts of institutions such as IPGRI to stem the erosion of crop landraces. He said that Ghana and other countries would look forward to implementing recommendations emerging from this consultation.

The Minister then expressed his concern that the recommendations of the consultation do not fall on deaf ears. He made reference to the MSSRF film on the tsunami and stressed the quote of Prof Swaminathan in that film, that 'an ounce of action is better than a ton of theory'. The consultation should package its recommendations in a simple manner that is not too technical.

The Hon E. Debrah delivering his inaugural address.

Minister Debrah said that he had known little about biodiversity before the consultation. He now knew that the world's population depends on three main grains, maize, wheat and rice. If any one of these are faced with a problem such as a major disease or pest outbreak, the world will be in the throes of a disaster. So, if the politician were to receive a simple message like that, he would extend all the necessary support.

The Minister made the point that biodiversity is a global phenomenon. It benefits rich and poor countries alike. Ways should be explored not merely to share the benefits but also the costs of conserving biodiversity. He hoped that the consultation would provide clear directions for the future with regard to the many challenges of biodiversity and the questions it raised. He extended warm thanks to MSSRF and the other organizers of the consultation.

Vote of Thanks by Dr S. Bala Ravi, Consultation Organizing Secretary, MSSRF

Dr S. Bala Ravi, concluded the inaugural session with a vote of thanks. He thanked the Ministers from Ghana, Kenya and Sri Lanka, and the Minister from Tamil Nadu, the donor organizations (IFAD, SDC, CIDA, Syngenta Foundation and Ford Foundation) who had made the consultation possible, the representatives of the donor organizations, Dr Emile Frison and his colleagues from IPGRI, Dr O. Smith of GFAR, Prof V.L. Chopra, Member, Planning Commission, Government of India, Dr Gustafsson, representative of FAO in India, the diplomatic representatives of various countries, Dr Stefano Padulosi of IPGRI, in particular, for initiating the idea of the conference, his colleague Dr Irmgard Hoeschle-Zeledon of the GFU, Prof M.S. Swaminathan, Chairman, MSSRF, for his valuable guidance and strategic support all along, all the staff of MSSRF, the many delegates from near and far, including representatives of farmers' associations and non-governmental organizations, and the national and international media.

SESSION I: BIODIVERSITY AND LIVELIHOODS (Morning Session)

Chair: The Hon E. Debrah, Minister of Food and Agriculture, Ghana

The first technical session dealt with the theme of 'Biodiversity and Livelihoods', and spread across the morning and afternoon of the first day. The session had five invited presentations and one contributed paper on *Harnessing biodiversity and indigenous knowledge for food security, livelihoods and nutrition*. All presentations were followed by a discussion.

'Diversity, nutrition and food security: the case of African leafy vegetables'

by R.K. Oniang'o, Founder, ROP, Kenya.

Dr Ruth K. Oniang'o presented the first paper of the session, providing an in-depth description of recent achievements as well as the extensive possibilities related to the use of African leafy vegetables (ALVs) in sub-Saharan Africa, an area where the proportion of poor people is considered to be the highest in the world. Referring to the declining vegetable and fruit consumption in the region over the years and the consequent disasters to health caused by lack of micronutrients, the paper highlights the fact that, ironically, the area happens to be endowed with a high diversity of under-utilized micronutrient-dense vegetables and fruits. These vegetables and fruits, well adapted to local conditions and easily accessible to the local people, have been found to contain a much higher level of micronutrients than the more commonly-used exotic vegetables. The indigenous vegetables have been neglected in research and extension efforts, in favour of just a few exotic choices.

Ruth Oniang'o delivering her presentation during Session I.

The paper goes on to describe the very positive impact and achievements of a project initiated by IPGRI, in partnership with several institutions in sub-Saharan Africa, to enhance the role of ALVs in improving the nutrition and livelihood status among vulnerable groups, especially women and children. It also describes the considerable success achieved in the promotion of ALVs in Kenya, where their production has now actually become a profitable venture! Two case studies are included in the paper and it describes the success stories related to the Millennium Development Goals.

Dr Oniang'o concluded with a warning that if the reported success in the adoption of under-utilized, micronutrient-rich vegetables is to continue,

governments and research institutions must quickly get together to put the necessary policies in place to further their promotion, conservation and utilization.

'Asian tropical fruits deliver social and economic benefits'

by K.Md. Tahir, Chief Executive Officer, International Tropical Fruits Network, Sedang, Malaysia

There has been enormous growth during the last few decades in the production and export of tropical and sub-tropical fruits from the Asia-Pacific region, raising incomes and expanding job opportunities. In this paper, Dr Tahir discusses the social and economic benefits contributed by tropical fruits, which are rich in nutrition, containing vitamins, fiber and phytochemicals extremely beneficial to health and also in disease prevention. Socially, emphasis is given to the nutrition and human health aspects.

The paper points to the predicament of 'hidden' hunger resulting from an unbalanced diet, lacking in micronutrients – vitamins, minerals and other essential diet components - and in particular the serious problem of Vitamin A deficiency (VAD) which frequently causes blindness in children and increases the risk of severe illness and death. This dietary lack can be met by the consumption of tropical fruits and vegetables, both the traded and less-traded categories, which contain valuable vitamins including vitamin A, antioxidants and fiber. The paper lists the other nutrition and medicinal benefits to be gained from these items, also providing statements from the Cancer research agency, and points out that a vast treasure of potential nutritional values contained in the less-traded, under-utilized and exotic tropical fruits needs to be elucidated and exploited.

The paper also discusses the issue of market access and the need for developing countries to conform to market access requirements. On the problem of post harvest losses, the paper cites a successful example of a simple post harvest technology developed at the Indian Agricultural Research Institute in New Delhi.

But the full potential of the tropical fruit industry is yet to be realized, said Dr Tahir. Much still needs to be done by way of research and development, technology transfer, higher productivity, and greater supply-chain efficiency. His paper highlights many of these issues.

'Andean grains and tubers: ancient crops for better livelihoods today'

by G.J. Blajos Kraljevic, PROINPA, Bolivia

Andean grains and tubers offer a series of opportunities to significantly improve the food quality and quantity of rural and urban populations in the region. In this paper, Dr Blajos Kraljevic looks at how these two important Andean crops can contribute to improving food availability and reducing poverty.

The exceptional nutrition value of Andean grains is discussed in detail, as well as the very positive agronomic aspects. It is necessary to promote the consumption of these grains locally, so as to increase their use among the population, and create food habits. The growing export market for novel end-products is also discussed, as well as the potential of increasing demand for the primary product, described as a natural source of vegetable proteins and essential amino-acids, with the addition of promising pharmaceutical uses as well.

Eight thousand years ago, the Andean cultures domesticated the potato. Although potatoes are consumed worldwide, there are other tubers and potatoes of varying species called 'native potatoes' which are not well-known but give food support to millions of farmers in the Andean region.

The consumption of native potatoes and other tubers in urban zones is very low indeed. For many farming areas, however, they are practically the only production option but despite this, threats of losing these crops are high, due to the reduced market.

In view of this situation, non-traditional alternatives must be found to create massive consumption of these species and in this way the agro-industry can be seen as an attractive option. Pilot experiences with the export of frozen pre-boiled native potatoes and native chip potatoes are encouraging but the task is a complex one. An improvement program is required to adapt the nutrition potential of the native varieties to current market systems.

"Grains and Andean tubers provide the opportunity to significantly improve the quality and quantity of food for rural and urban populations", said Dr Blajos Kraljevic. "They also signify higher incomes for farm families. It depends on us to make the best use of these opportunities".

The Chairman then summed up the presentations of the three speakers. It was agreed that the afternoon session would also include a discussion on the presentations made in the morning session.

(Left to Right): G.J. Blajos Kralijevic, PROINPA; Domenico Bagnara, Italian Academy of Sciences; Parasu Raman, MSSRF; Cheikh Alassane Fall, CORAF/ WECARD; and Kirsten Probst, GTZ, chatting with Prof Swaminathan, MSSRF.

SESSION I: BIODIVERSITY AND LIVELIHOODS (Afternoon Session)

Chair: Prof H.P.M. Gunasena, Executive Director, Council for Agricultural Research Policy, Sri Lanka

A view of the high table during Session I (afternoon), chaired by Prof Gunasena, Executive Director, Sri Lankan Council for Agricultural Research Policy, and Chairman, APAARI.

'Managing biodiversity for improved community well-being'

by Setijati Sastrapradja, Chairwoman, Naturae Indonesiana, Indonesia

Dr Sastrapradja presented the first paper of the afternoon session, giving an overview of the state of biodiversity in Indonesia. Hitherto a natural 'blessing', biodiversity has been greatly affected by recent political instability in the country and its gradual loss has hit traditional communities whose livelihoods depended on it. Since the natural environment of these communities has now changed, and they feel overcome by the competition of 'newcomers', they need to be empowered with knowledge in order to tap new options and adapt to unavoidable change.

The ecosystem approach has been identified and used to holistically manage biodiversity. The paper discusses the challenges involved, the key factors contributing to a community's success in managing biodiversity and the question of sustainability.

Dr Sastrapradja presented examples of how biodiversity for the provision of human needs is being managed at the local level in some areas of Indonesia, although even at such a level its management is a complex matter. Her paper discusses the difficult and precarious situation regarding land ownership in the country, as well as the limited advantages of 'protected areas', intended to ensure that biodiversity will remain intact within them. Unfortunately, in less than a decade, most of the protected areas in Indonesia have been vandalized.

Setijati Sastrapradja, Chairwoman, NATURINDO (Naturae Indonesiana), addressing the Plenary.

There is an overwhelming need for community participation if conservation is expected to work. In this respect, the difficult issue of combining activities to improve community livelihoods and at the same time conserve biodiversity is also discussed. The paper also describes some of the successful work undertaken in the field of community development, part of which is related to livelihood improvement through agricultural practices. These activities are also, in part, related to the conservation of biodiversity. Examples of community empowerment initiatives on the part of government, international and local NGOs, community-based organizations and the private sector are also provided.

The paper comments that although, in today's world, seeking cooperation takes time and does not always guarantee success, a holistic approach to biodiversity seems to be the best option, and should be pursued with optimistic perseverance.

'The Market Map: a framework for linking farmers to markets'

by A. Rob, Team Leader, Markets and Livelihoods Programme, ITDG, Bangladesh

This paper draws on the assumption that farmers and producers need to acquire 'market literacy' which is described as "awareness, understanding and capacity to build the processes, institutions, competencies and relationships that enable markets to work for poor producers".

Dr Rob emphasized the fact that rural poverty reduction policies and strategies aiming at the creation of sustainable livelihoods for the rural poor are being undermined by the loss of species and the degradation of ecosystems. The lack of progress towards the Millennium Development Goals points to an urgent need to address declining incomes. Small-scale farmers, growers and landless harvesters are connected to market channels that could have the potential to provide them with a better future.

The paper stresses the need for a better understanding of how market systems work, in order to determine where interventions should be directed, and which markets and channels offer the best prospects for enhancing the livelihoods of poor producers. Within ITDG, the market map has proven to be an invaluable framework for strategic development of the international programme 'Making Markets Work for the Poor'.

Agencies such as agricultural research institutions should use such a map as a tool of systemic analysis in order to overcome policy challenges. They should build 'market-literate' capacity within their organisations; co-ordinate a coherent strategy; inform and influence contacts at the macro level; support and empower contacts at the micro level, and facilitate inputs and services.

Presenting a case study on the marketing of *aloe vera* by small farmers in Kenya, Dr Rob stated that the first step had been initial analysis and mapping. This established that farmers' problems and needs were related to ending their physical and commercial isolation, gaining access to technology, knowledge and skills and overcoming their lack of trust in market chains.

Dr Rob highlighted the importance of developing 'in-house' capacity for market mapping and PMCA within organisations, particularly those focused on poverty alleviation. The paper closes with some suggested 'lessons' for governments and donors.

Prof Gunasena referred to the five points highlighted by the speakers. The first was *the strong political commitment needed for biodiversity and conservation*, and in this context he felt it was fortunate that four Ministers from different countries were present at the consultation. The other points concerned *livelihood security, empowerment of communities, education and community leadership.*

From the foregoing presentations, it emerged that four distinct areas need urgent attention, said Prof Gunasena. First, the need to create and strengthen awareness among everyone in society regarding the importance of biodiversity. An action plan could then take shape at the ground level. Second, the need for institutions - formal or informal - to take biodiversity forward. Third, capacity building as an essential requirement; and fourth, the importance of getting communities to take up and promote biodiversity. "People are the custodians of biodiversity. It is they who destroyed it, it is they who must breathe life into it."

"People should be able to make a living out of biodiversity, out of what they have in their own home towns, villages and communities", said Prof Gunasena. "How can we link up biodiversity with the markets? How can we take people from the villages to the markets? Dr Rob from Bangladesh gave us a visual roadmap. It seemed rather complicated, but it was still a roadmap. It would be useful if it worked at a simple level."

Everyone is of the view that the products of biodiversity should be value-added. "They should be sold in markets in a competitive manner and the farmer should earn from them. Only then is conservation possible."

Discussion

Following the above presentations, the floor was declared open for discussion. Important points made by the participants and clarifications offered by the resource persons are captured below.

Mr Peter Griffee, Senior Officer, Industrial Crops, FAO: With reference to the presentation made by Dr Rob, I would like to comment that without going into very

complicated diagrams on market maps and analysis, I came across success stories in biodiversity marketing. I am referring to the work of self-help groups of marginalized women organized by the Covenant Centre of Development in Madurai, India. Here, the women's self help groups manage their own small businesses through their own market chain, with virtually no external inputs. What is needed, I found, is just local champions and their own wisdom, and not necessarily the skills gained through literacy. The model on linking farmers and markets discussed by Dr Rob looks complex and complicated, requiring a lot of analysis. There are many products I may like to market but if I have to undertake such an analysis each time, it would be daunting. Is there a certain minimum one can do to link farmers to markets?

I too would like to put some points for the group discussion tomorrow. The biodiversity we are talking about involves plant species, but we haven't spoken about their environment, including soil, water and air. Biodiversity has to be seen and used as an integral part of the environment, where the importance of soil health, good agricultural practice, and good manufacturing practices have to be recognized. Again, apart from food and nutrition, biodiversity can also meet the need for bio-fuels. For example, we are working with China in using marginal areas for sweet sorghum for the production of ethanol. Thus, biodiversity can help us in many ways, all contributing to the reduction of extreme poverty and hunger.

Dr Rob: The options depend on who is actually using the market map. If an entire community is doing so, it could have its own system. It can work through a single market chain. But the organization that has to guide the community should introduce the appropriate market map and analysis.

Dr Msemakweli, General Secretary of the Uganda Cooperative Alliance, Uganda: I would like to comment on Dr Oniang'o's presentation regarding leafy vegetables in sub-Saharan Africa. She emphasized the need for producers to set up partnerships with efficient markets. That is undoubtedly extremely important. But what we see in Uganda is that farmers and supermarkets are not equal partners. Sometimes, farmers don't even get a contract from the supermarkets. The supermarkets buy from the farmer when it is convenient for them; at the end of the season, they slash the prices unilaterally without consulting the producers. Or sometimes, they buy only half of what has been produced. So my advice to farmers would be to diversify sales links. Sell to supermarkets, but also to other shops and traders, otherwise you are taking a risk.

The issue of trust is very important in markets - not just trust between buyers and sellers, but also trust within the producer groups themselves. In Uganda, marketing systems collapsed because the government was not procuring or buying crops from farmers and marketing them, as it used to do. But the collapse occurred also because farmers didn't want to entrust managers with their produce. They were worried that if they handed over their produce, they might never get paid. However, we are now working to establish trust between managers and producers.

Dr Oniang'o: Let me clarify that farmers in Kenya do sell vegetables locally and don't depend exclusively on supermarkets. At one time, the vegetables were not even being eaten locally, but now the local community is the main market for

them; the demand is enormous. We also obtain seeds from the farmers and promote them in Nairobi through an NGO called Family Concern. This NGO then links with individual farmers, and ensures that they are not at the mercy of supermarkets.

Dr Sivakumar, National Institute of Nutrition, Hyderabad, India: Did you all know that the website for the Millennium Development Goals doesn't even mention biodiversity as a strategy? I think it is only in the last couple of years that biodiversity has been linked to some of the MDGs. But let's be cautious about this, in view of what we have heard today with regard to marketing biodiversity. Maybe we haven't yet made the connection between biodiversity and rise in purchasing power or food consumption. Another point is that some 25 years ago, nutrition was talked about a great deal; we heard a lot about protein-energy management and micronutrient management, not about food security. Food security has now become the big buzzword.

Group of participants during Plenary discussion.

A question for Dr Tahir: In 1995, IPGRI and FAO together called for prioritization of under-utilised fruits for three years. Do you want such prioritization to continue or change in some way?

Dr Tahir: Every country should prioritize the crop or fruit it would like to promote, because what is under-utilised in one region or country could be a commercial or traded crop in another. Sometimes new products could spring up within a single commercial crop. Let me give you an example: in the past, when we talked about exporting pineapples to Europe, we discussed sweet and savoury flavours. Now we talk about super-sweet pineapples as well. It is the same crop, but we are adapting or adjusting it to consumer needs. So, promotion of under-utilised crops has to be market-driven, consumer-oriented. Take the kiwi, a Chinese gooseberry. It took New Zealand some time to develop it into a global fruit.

Every country has to study its comparative advantage and promote that. In Malaysia, we promote carambola or star fruit. Very few countries in the world produce it - in fact, I think we are the biggest exporters of star fruit to Europe. How did it happen? It was driven by the market. The Government came in later to assist the industry in developing that particular crop because of the demand for it. So there was market promotion and branding, R & D on increasing the productivity of that particular crop, and improved post-harvest technology for storing and packaging. The government thus provided a whole range of support actions. The government listens to the industry, the private sector and the consumers, regarding what they want. So I cannot offer any particular formula. Several issues need to be looked at.

Prof Gunasena: More than market-driven actions, you are referring to the creation of markets for different products, such as the kiwi fruit.

Dr T. Johns, Centre for Indigenous Peoples' Nutrition and Environment, Canada: My question too is for Dr Tahir. The discussion I have heard about how the poor will attain better nutrition, and how we will meet the Millennium Development Goals of poverty reduction, leaves me perplexed. The items we have been talking about are among the most expensive, they are out of reach for poor people. If we have income generation and poverty alleviation in mind, most of the models or examples you have talked about are not appropriate because they are highly capital intensive. I wonder whether you have any examples of fruit that really can be used to reduce hunger and poverty, and of markets for such fruits.

If there is one thing that can benefit the poor and make biodiversity a tool to meet Millennium Development Goals, it is capital creation. We have been talking about generating incomes: the poor earn some income to meet basic needs, but that does not rescue them from poverty. Until they actually possess capital, control capital and manage their own affairs, and until we create more entrepreneurs, poverty will not be reduced.

Dr A. Kumar Anjan, General Secretary, All-India Farmers' Union: Ruth (Oniang'o) spoke about farmers and supermarkets in sub-Saharan African countries. But who goes to the supermarket? A microscopic minority of society.

We must bear in mind that this whole issue of biodiversity, food security, better health and overall development, is a matter of concern to common people. If they are to benefit, if the desired Millennium Development Goals are to be achieved, state intervention is very much required. The state must come forward to help poor marginal farmers with quality seeds, quality infrastructure, quality farm inputs. This will make marginal farmers competitive, and empower them to benefit from liberalization by linking their production to markets. Such social support is very much needed.

Dr S. Rajagopalan, MSSRF: Market linkages alone will not ensure that poor people are able to consume a product that is sold in the market. There are lessons from the milk sector. Small milk producers have been linked, they are now able to market their produce and get better prices. But milk consumption in milk producer households has decreased. They have money, but nutrition has not been taken care of. What do they do with the money? Do they buy more milk or other items? We do not know. But market linkages *ipso facto* will not ensure nutrition.

Dr S. Bala Ravi, Advisor, Biodiversity, MSSRF*:* I have been working for quite some time to popularize nutritious millets or the so-called coarse grains. I can say that without market linkages and better profitability, it is difficult to make farmers grow these crops. Not much support for this kind of work comes from Governmental institutions. In southern India, at least, the production of nutritious millets had been diminishing. But suddenly, in recent years, we find flour and rice made from many of these millets coming into urban markets, including supermarkets and there is steady demand from urban consumers. Whereas in the past the urban market for these millets was virtually absent, today the same millets well-packaged as flour or de-husked rice, fetch double the earlier prices. From the farmers' side, they are not

able to reach the urban market directly and the economic advantage to be gained by the new demand is largely cornered by the middlemen. So we see the contradiction of a new market and declining production. This calls for appropriate policy and capacity building to empower producers with processing technology, credit service and market access. The rewarding potential of such integrated production, value addition, product development and marketing is demonstrated in MSSRF's work on nutritious millets in Kolli Hills in Tamil Nadu and Jeypore in Orissa.

Dr L. Bhattacharjee, Consultant, FAO Regional Office for Asia and the Pacific, Bangkok: I have a very basic comment about creating nutrition awareness and knowledge. We have been talking about it in different ways, but one of the main challenges is how can we mainstream nutrition education into our agriculture and nutrition programs? At a meeting in Cyprus in 1992, WHO and FAO together developed food-based guidelines. Several initiatives followed over the years, with countries coming up with their own food-based dietary guidelines. In principle, these are meant to be tools for agriculture and health, as well as education.

We have been following these guidelines constantly. But we find that we still have a long way to go. We talk about leafy vegetables, millets and so on, but the challenge lies in trying to enhance consumption of these varied diets by the people and definitely at the grassroots. So my question is, are we really linking up nutrition with agricultural programs?

Participant: It is not easy to change nutrition behaviour. People often treat nutrition as a soft area and are not really keen on taking it up. I think we need a little push and advocacy from those concerned with agriculture, health and education, for food-based dietary guidelines which could be a very effective tool.

Dr G.K.A. Brantuo, Ministry of Food and Agriculture, Ghana: The whole issue of the role of supermarkets and their significance would depend on where you are. In my country, Ghana, it is unthinkable that somebody would go to a supermarket to buy vegetables and fruits. We go to local markets or to many other places. When I went to Kenya, I was shocked to see a big supermarket complex with vegetables for sale. This is normal in Kenya, but not in Ghana. Another issue is the effect on people's mindset. When they get to know that vegetables are for sale in supermarkets, then vegetables gain in importance, and even the roadside vegetable vendors begin to upscale their prices.

We have also been hearing about the problems with inter-sectoral coordination on some of these issues. Nutrition people do not sit in departments of agriculture. Mechanisms must be devised for inter-sectoral dialogue to move these issues forward.

What Dr Bhattacharjee said about "mainstreaming" is very important because it starts with the hypothesis that you can't do something yourself within the framework you have. We who talk about agricultural biodiversity should realize that we will not even figure in the Millennium Development Goal strategies if we just keep talking about biodiversity.

I feel that the challenge is really to identify a means of penetrating the broader issues in meetings where the people are not specifically discussing biodiversity,

and plant our ideas there. Sometimes such meetings may have nothing to do with agriculture, they have to do with planning. But we should bring in biodiversity.

Mr Chairman, the point I am making is that we need to change our strategy. We must figure out mainstreaming, how do we build these elements into the wider perspective; the poverty reduction strategic plans, the national food security strategic plans? It is not only agriculture people who should deal with these issues; the importance that biodiversity makes to the livelihood and nutrition of the poor should be heard everywhere. This is the challenge we must tackle.

Dr Warnasurya, Secretary, Ministry of Agriculture, Sri Lanka: I am not a marketer myself but I would like to draw the attention of the Consultation to the four Ps of marketing - *product, promotion, place* and *price*. Today, we are no longer familiar with the eating habits of our forefathers; tomorrow, our children may not know what we are eating today. Our food menu has become very narrow. This is not just in relation to leafy vegetables. Over the years, we have narrowed down our food products in the name of development.

We have been talking about the vast potential of biodiversity to alleviate food scarcity and under-nutrition. But let us discuss the power of the media. Media can create markets through various types of propaganda. They have created markets for products that may not be nutritious. And even the poor fall for the propaganda. They sell what is nutritious and buy what is not. Therefore, scientists ought to educate the layman by introducing the four Ps of marketing and properly promote nutritious products in local markets for the benefit of the poor.

Prof Gunasena thanked the speakers from both sessions for their learned and valuable presentations, and all those who took part in the discussions.

The participants then interacted with women's self help groups from the Kolli Hills, Jeypore, Wayanad and Kannivadi centers of MSSRF. The various groups provided a very effective display and demonstration on the use of local biodiversity for local consumption, value added product development and marketing for enhanced income generation.

View of participants during the session chaired by Prof Gunasena.

SESSION II: BIODIVERSITY AND POLICIES

Chair: The Hon M. Akaranga, Assistant Minister for Agriculture, Kenya

The second session dealt with 'Biodiversity and Policies', and was chaired by The Hon M. Akaranga, Assistant Minister for Agriculture, Kenya. This session had three invited presentations, followed by a discussion.

'International policies dealing with biodiversity and their impact on achieving the Millennium Development Goals'

by M. Hermann, Senior Scientist Genetic Diversity, IPGRI, Colombia

Dr Hermann stated that liberal access to Plant Genetic Resources for Food and Agriculture (PGRFA) is the key to research and crop improvement programs aimed at reducing hunger and poverty.

This paper assesses the degree to which the existing international legal framework promotes uses of genetic resources for food and agriculture (GRFA) that will assist in meeting the MDGs. Despite recent positive developments in some areas of law, the overall international legal framework still does not provide a secure and predictable basis for research, conservation and uses of GRFA that maximizes the potential benefits for the poor. The paper discusses ways of regulating access to GRFA and sharing the benefits derived from their use. In this light, the International Treaty for Plant Genetic Resources for Food and Agriculture is part of the present analysis, as an instrument designed to create an enabling environment for using PGRFA for research, breeding, conservation and production.

The Hon M. Akaranga, chairing the second session, pictured with Prof Swaminathan, (right) and the Hon A.K. Dissanayake.

The paper discusses the potential threat that the European Union's Novel Food Regulation Act (NFR) has posed to income generation in developing countries and to the livelihoods of poor farmers, by its stringent food safety standards. It outlines a number of considerations that should be taken into account for the currently-discussed amendment to the NFR, in the interest of enhanced trade in sustainably-produced biodiversity products from developing countries, and diet diversification within the EU.

'Marketing biodiversity and benefit-sharing: a product development perspective'

by N.P. Louwaars, Senior Scientist Biopolicies, Center for Genetic Resources, WUR, The Netherlands

This study deals with the problem of sharing the benefits arising from marketing biodiversity and the need to guarantee conservation. Four types of values commanded by biodiversity and genetic resources are analyzed: option, production, culture and market values. While the first warrants careful ex-situ conservation, the others have immediate relevance for on-farm management of genetic resources.

The paper looks at international agreements, such as the CBD and the IT-PGRFA, their intentions and their failings. The CGR has studied opportunities for using other IPR systems to create more market value for genetic resources and to arrange for sharing of benefits by the farmers and communities that developed and maintain such diversity. Some notable examples of benefit-sharing illustrate the search for effective instruments and various institutional framework agreements The paper discusses, among other issues, the challenges confronting developing countries in order to benefit from the utilization of genetic resources and the necessary requirements.

Particular attention is devoted to conventional Intellectual Property Rights, such as patents and breeders' rights, which do not seem to support diversity-based marketing approaches. Private rights provided by intellectual property systems are better linked to market approaches than the public rights provided by genetic resources agreements.

Also discussed is the experience of the Community Biodiversity Conservation and Development Programme, and the encouraging results of two recent, successful endeavours. The paper discusses marketing mechanisms to capture potential value in the market, and the necessary requirements for same. Ways in which to deal with competition from outside are also dealt with in detail, as well as additional tools needed to protect the communities that originally developed and maintained a particular variety, after it starts attracting customers from outside. The paper goes on to discuss the collective nature of farmer-breeding, remarking that the incompatibility of private ownership and the collective nature of genetic resources in traditional farming communities is closely linked with the debate on alternative options for the protection of traditional knowledge. On the issue of IPRs in marketing, it outlines the two types of rights that protect the marketing of products through alternative principles.

Finally, this study looks into opportunities for supporting and partly protecting markets for diversity-based specialty products, and the challenges ahead.

'Indian legislation on biodiversity'

by Prof M.S. Swaminathan, Chairman, MSSRF, India

India is one of the few countries that have enacted national legislation on biodiversity, an important means of harnessing biodiversity to meet the first Millennium

Development Goal (MDG) of reducing poverty and hunger. Prof Swaminathan provided a full description of the two important laws on biodiversity now in place, namely the Protection of Plant Varieties and Farmers' Rights (PPVFR) Act of 2001, and the Biological Diversity (BD) Act of 2002.

In a country such as India, where agriculture is practiced mostly by small resource-poor farmers, there is a great need for higher crop productivity, and the primary catalytic technology for increasing crop productivity is good seed. Biodiversity conservation and sustainable and equitable use are therefore fundamental to achieving MDG 1.

Some issues of particular importance thoroughly discussed by Prof Swaminathan in his paper relate to accessibility of biodiversity technologies for all, and social inclusion and benefit sharing in agriculture, in line with the principles of ethics and equity, highly stressed in the Convention on Biological Diversity.

Within the context of the PPVFR Act, several issues are analyzed: the multiple roles played by farmers, the role and importance of private investment, as well as proprietary rights, IPR, and patent rights - now of growing significance. Prof Swaminathan discusses at length the need for Farmers' Rights and the importance of an international right regime concurrently conceding Plant Breeders' Rights and Farmers' Rights. In this regard, the study looks at the pros and cons of compulsory licensing and participatory breeding.

With regard to India's recent developments in this field, an important initiative is the setting up of a documentary and digital database on traditional knowledge and community innovation, intended to combat the unethical tendency to misappropriate plant genetic resources and important traditional knowledge.

'Protecting and strengthening local food systems: harnessing biodiversity and indigenous knowledge for food security, livelihoods and nutrition' *

by L. Bhattacharjee et al.

**This paper was not presented at the Session but was distributed to participants*

In this paper, which discusses the benefits to be gained from linking biodiversity and indigenous knowledge, the authors call for immediate action to promote the use of biodiversity in food security and nutrition programmes, as a major step towards achieving the Millennium Development Goals (MDGs). The paper provides a description of FAO's activities in relation to indigenous peoples' food systems, dietary diversity and nutrition in Asia. One of the points emerging from FAO's experience in this field is the strong preference on the part of indigenous peoples for health promotion activities that involve the use of their own local food.

Among the many urgent requirements discussed is that of documenting indigenous peoples' food systems and ensuring that irreplaceable traditional knowledge (including unique food species and processing methods) remains in tact

to be handed down for future generations. There is a description of an interesting pilot project carried out by the Government of Lao in collaboration with FAO, to promote home gardens for improving food security and nutrition well-being. The pros and cons of home gardening techniques are discussed in detail as well as the different models developed by FAO and the successful outcome of the pilot project. The important role of women is stressed with regard to the management, production and utilization of home garden produce, and their knowledge with regard to conserving local varieties is considered vital.

FAO, in collaboration with the Centre for Indigenous Peoples' Nutrition and Environment (CINE), carried out five case studies in four Asian countries, to define the best method for documenting indigenous peoples' food resources, with the long-term goal of using these resources for programme planning to ensure adequate diets and good nutrition status. An interesting discovery was that of a particular traditional food system where 97 foods were used, including a variety of plants, domestic and small animals and local fish. Also described is a national agricultural biodiversity programme, developed by FAO, UNDP and NAFRI, as a long-term strategy for implementing a coordinated approach to better use, development and conservation of agricultural biodiversity.

In conclusion, the paper addresses the issue of limited documentation available regarding the nutritional value of traditional foods, and calls for further research to increase the knowledge of the nutrition qualities of indigenous foods, which would also increase the promotion and marketing of these important items.

Following the above presentations, Minister Akaranga then gave the floor to those wishing to make some brief comments. Unfortunately, there was time for one intervention only, before the start of the following event.

Discussion

Mr Peter Griffee: Thank you, Mr Chairman. I would like to make a slight modification to the point that was made in the first presentation by Michael (Hermann). Regarding the International Treaty, I think it is important for us to realize that the treaty covers *all* plant genetic resources for food and agriculture and that the multilateral system is an important component of this treaty. The Annex of the Treaty now covers only 35 field crops and about 80 forage crops.

Leading the discussion, The Hon Akaranga, together with The Hon Dissanayake, and Dr V.L. Chopra, Member of the Planning Commission, India.

But the main essence of the Treaty covers all plant genetic resources important to food and agriculture and we need to emphasize this, for the purposes of conservation and all associated activities.

Minister Akaranga: Ladies and gentlemen, we have been requested to move on to the Public Forum immediately but before doing so, I want to take this opportunity to thank those who presented this afternoon's papers. As you will all agree, they have done very good work. Dr Hermann from Colombia covered the international framework on biodiversity. He discussed several issues, including marketing diversity and sharing the benefits, and marketing access for biodiversity products. He also illustrated the linkage between the PGRFA and the Millennium Development Goals.

Dr Louwaars came in very strongly on the issue of marketing diversity and sharing the benefits with primary conservers. He discussed value addition, explaining each of the different values in detail and showed to us how these values could be equitably shared with the farmers – traders, hawkers and retailers. He also discussed trademarks which, he said, do in fact add value accessible by farmers. This is important for the farmers and we have to protect their products. I want to thank Dr Louwaars also.

Prof Swaminathan covered two pieces of Indian legislation or Acts that protect biodiversity: the Biological Diversity Act, 2002, and the rights of plant breeders and farmers – the Protection of Plant Varieties and Farmers' Rights Act, 2001. This is indeed something that some of us have to carry back home, as we also need to protect our national biodiversity and farmers' rights. Do we have any act in place to protect our farmers? Because, here we are talking about achieving a certain aim or goal which we cannot achieve if we don't provide on-the-ground protection to the intellectual property of farmers associated with the rich plant genetic resources they had generated. I think this is very important, especially for us politicians who are here today: we now have to pursue what we have discussed in this hall.

I also recommend that for such forums we invite as many politicians as possible. It may, perhaps, help in having better-informed debates on such issues in their Houses and in influencing their national policies on the subject. For example, Professor Ruth Onyang'o and myself are here and I am sure that we are going to make a difference in Kenya with regard to recognition of the value of biodiversity.

Thank you very much.

SESSION III: GROUP DISCUSSIONS AND INPUT TO RECOMMENDATIONS

Chair: Prof M.S. Swaminathan, Chairman, MSSRF

During the morning of the second day of the consultation, the participants divided into four groups and conducted concurrent discussions on the thematic area assigned to each group. The thematic areas and the chairpersons assigned to these groups were as follows:

Group 1: Food and nutrition security
(Chair: J. Jaftha, Department of Agriculture, South Africa)

Group 2: Biodiversity and socio-economics
(Chair: K. Atta-Krah, IPGRI, Kenya)

Group 3: Policies
(Chair: N.P. Louwaars, Centre for Genetic Resources, The Netherlands)

Group 4: The community perspective from members of Self Help Groups
(Chair: M. Velayutham, MSSRF, India)

Each group was requested to bear in mind the inputs emerging from the papers presented and also the discussions conducted on the preceding day, in Sessions I and II. In addition, the groups were provided with the following terms of reference, with respect to the feedback needed for developing the draft recommendations to be adopted by the consultation:

1. Reflect on the role of national and international policies in enhancing the contribution of biodiversity to reduce hunger and poverty, as presented on the first day of the Consultation. Elaborate strategic issues, identify important additional aspects that might have been missed by the presentations and suggest a consolidated statement to best highlight the role of policies in support of people's livelihoods through biodiversity;

View of the high table, with Prof Swaminathan, Session Chair, The Hon Debrah, Emile Frison and The Hon Akaranga.

2. Identify major policy constraints that hinder the broader and more effective use of biodiversity to address hunger and poverty; and
3. Recommend two or three priority interventions at both national and international level with regard to policies to enhance the benefits of biodiversity in the area of food and nutrition security and income generation.

The four groups conducted their discussion accordingly, developed bullet points and presented same at Session IV, for further deliberations and finalization. These inputs were taken up by a drafting committee nominated to formulate the consultation recommendations.

Discussion Group 1 (Food and nutrition security), including Julian Jaftha, Dept. of Agriculture, South Africa (chair); Deepa Varma, MSSRF; Irmgard Hoeschle-Zeledon, Coordinator, GFU; Lalita Bhattacharjee, Consultant, FAO; Tim Johns, Mc Gill University, Canada; and Ruth Oniang'o.

SESSION IV: THE WAY FORWARD

Chair: Prof M.S. Swaminathan, Chairman, MSSRF

This session was designed to examine, discuss and harmonize the draft recommendations developed by a drafting committee and presented to the session. Discussion on the draft led to the unanimous conclusion that further improvement in style, content and language was needed and that this might require additional time beyond the duration of the consultation. Hence the drafting committee was requested to continue its task through e-mail with facilitation from the consultation organizing secretary, based at MSSRF. In view of the extra time available for finalizing the recommendations, participants were requested to send additional comments and suggestions electronically to the Organizing Secretary. It was the common desire of all participants that the revised and finalized recommendations should be on the basis of well-pondered inputs.

Prof Swaminathan reminded the participants that one of the important aims of focusing on biodiversity for addressing the Millennium Development Goal number one was that of enlarging the food basket to fight hunger and malnutrition at both local and global levels. This was the principle behind the Hunger Task Force Report which, for example, recommended the use of locally-available grains and other produce to provide a nutritious meal under the school noon-meal programme. The emphasis would be, to a large extent, on local resources to provide a diverse rather than uniform menu. This is particularly true in situations where donor agencies offer only one or two kinds of grains, such as corn, wheat or rice. There should be flexibility to buy and use local grains and other produce. As this gathering has representation from some 25 countries, it is well placed to make concrete recommendations on the matter or to create some broad guidelines. Within these, one may have to adapt the recommendations to one's own situation, either in the case of legislation such as farmers' rights, etc., or in the designing of school feeding menus. These have to be harmonized with or tailored to local conditions or existing policies and legislation. Recommendations from an international conference such as this may be too broad and generalized in scope. Therefore, each of the countries represented should use the recommendation as a framework for developing a nationally affordable plan of action, appropriate for each country. Without such a plan, moulded to national requirements, the recommendations will remain merely as one of the many papers on the millennium debate.

Two specific suggestions were: First, that all participants in the consultation, and also those who were unable to be present, provide any additional inputs they think appropriate for insertion in the final document, within the next two weeks. The resulting recommendations should clearly state why biodiversity is important for the elimination of poverty, and how it could contribute to reducing hunger and poverty as well as meeting some of the other Millennium Development Goals.

Second, that participants from each country represented take the initiative in developing a national action plan in their own country, relevant to the socio-economic

and political conditions in their respective areas, in keeping with the recommendations of this consultation, and try to influence their governments to act upon the action plan. The Honourable Ministers present would be in a better position to influence their own respective governments in implementing the plan.

The final recommendations emerging from this consultation were printed as a separate document, copy of which is provided on p.41, entitled 'Chennai Platform for Action'.

SESSION V: CLOSING AND WRAP-UP

Chair: Dr E. Frison, Director General, IPGRI

In the closing and wrap-up session, concluding statements on the significance of the consultation were delivered by panelists representing different stakeholders, such as the donor organizations, farmers' associations, national and international media, non-governmental organizations, and others. The full texts of these statements are provided in **Annex III**.

Dr Frison thanked the participants for their contributions and hoped that the final recommendations emerging from the consultation would have great potential for drawing focus on biodiversity to achieve the MDG on hunger and extreme poverty. He also referred to the impact of biodiversity on health and nutrition. Commenting that the task was not yet finished, Dr Frison stressed the need to ensure that these messages get across and help in leveraging action at the national level, where much has to be done.

Emile Frison, Director General, IPGRI, chairing the session, together with (left to Right): Martin Sommer, Swiss Agency for Development and Cooperation; The Hon Akaranga; The Hon Dissayake; and The Hon Debrah.

In calling for support to the Chennai initiative at the international level, Dr Frison urged ministers present at the meeting to ensure the support of their country's representatives to the initiative at the September meeting of the UN Assembly in New York. He looked forward to support from several FAO partners in this "cross-cutting initiative on biodiversity, nutrition and health" and expressed confidence that the Secretariat of the CBD would also support the initiative and place it on the agenda of the New York meeting.

Emile Frison, IPGRI, and Zinash Sileshi , FARA, visiting a stand set up by one of the Indian Women's Self Help Groups.

The Hon M. Akaranga, Minister of Agriculture for Kenya, in his closing remarks, shared the hope expressed by Dr Frison and stated that thanks to the consultation he could speak with authority and confidence on the role of biodiversity in combating hunger. He said that perhaps the concept of biodiversity needed to become a buzzword in policy matters on agriculture and the alleviation of poverty and hunger.

Minister Akaranga remarked that the consultation represented a mixed group comprising scientists, representatives of development agencies, policy-makers and ministers, representatives of farmer groups, the international media and non-governmental organizations. This diversity resulted in a rich exchange of experiences. Only a few ministers had taken part, however. Consequently, the message of the consultation must reach others as well because hunger is something we should all fight together. This might need lobbying, the holding of regional workshops in other places, such as East and West Africa, and wide media coverage. In other words, the consultation needed vigorous and pro-active support. He urged participants to ensure that the consultation led not merely to a declaration but to positive action.

Ms L. Wangari Mwangi, **Kenya National Federation of Agricultural Producers,** thanked the MSSRF for inviting NGOs and farmer organizations to the consultation and for incorporating their views in the recommendations. She pointed out that it is the small-scale farmers who suffer from hunger and poverty, so their voices must be heard. "We have seen the rural communities representing small farmers here and the display they set up", said Ms Wangari Mwangi. "It was good to see that they played an active part in the consultation and contributed to the output."

Dr A. Bennett, Executive Director, Syngenta Foundation for Sustainable Agriculture, Switzerland, said that for any idea to bear fruit, the right people had to come together and this required a lot of effort. He complimented MSSRF and IPGRI on their initiative and Dr S. Bala Ravi, the Organizing Secretary, in particular, for his patient efforts. "We are delighted to have been a part of that process."

"We all believe passionately in the role that biodiversity can play in increasing opportunities, options and choice. But we cannot underestimate the challenge of getting biodiversity onto an agenda that will ultimately make a difference. When targets were set for the MDGs, many things were left out. The difficulty now is how to get them back on the agenda!"

Dr Bennett felt the consultation was valuable in that it discussed the relevance of biodiversity and the contribution the latter could make. The consultation had something to offer - the organizers were not just asking to be heard, or looking for funds. It had struck a nice balance between what it could achieve for a wider agenda, and what it wanted to be done - in terms of land use and land management, for example.

Mr S. Vincent, Editor of the online *India Together*, who spoke on behalf of the media, said the problem of taking the biodiversity message to the public through the media had been raised at the consultation. In order to do this, specific individual stories relating biodiversity to health, nutrition, income, drought prevention or basic conservation, ought to be promoted, and reiterated continuously. A single big blast on biodiversity just before a conference might not be as effective in awareness-raising as a steady stream of stories throughout the year. He cited examples of a recent UNDP publication on the 100 greatest success stories in development and the World Bank-sponsored publication on the 50 greatest stories in development communication, which is available on the web. Likewise, a publication on the 50 best success stories in biodiversity would spark enormous interest in the media and among the public.

Participants visiting the stands of the Women's Self Help Groups.

Mr D. Pawar Yogesh, NDTV, India, agreeing with his colleague, Mr Subramanian Vincent, remarked that the space available for development issues in newspapers and magazines is shrinking. In fact, only a few newspapers or television channels have a staffer to cover agriculture. A single large story on biodiversity in the media was not practical. But the media would be interested in taking up individual case studies or success stories on biodiversity, or problems caused by lack of biodiversity.

Dr L. Bhattacharjee, consultant, FAO Regional Office, Bangkok, recalled an international conference in New Delhi where the 'mega-diverse' countries of Latin America, Africa and Asia brought out a draft recommendation. The editor of a leading national daily newspaper said the term 'mega-diversity' was not very explicit. "We need to have a slightly flexible mindset on how we describe such concepts to lay persons."

The consultation came to an end with a vote of thanks proposed by Dr Velayutham, Executive Director, MSSRF. He conveyed the Foundation's pleasure in collaborating with IPGRI and the GFU in organizing the consultation. He expressed gratitude to the five sponsors, namely CIDA, the Ford Foundation, IFAD, SDC and the Syngenda Foundation. He thanked the Ministers from Kenya, Ghana and Sri Lanka, and from Tamil Nadu; the lead speakers from the various sessions; the chairpersons, the rapporteurs and drafting committee members; the Hindu Media Resource Centre, which had organized a public forum, and Mr N. Ravi, Editor of *The Hindu*, who chaired the forum; the representatives of the media, the participants, who had come from 25 countries, the many self-help group members with whom the participants had interacted, and Prof M.S. Swaminathan, who had initiated and concretized the consultation process. He mentioned that the subject of biodiversity is very dear to Prof Swaminathan, who is frequently heard to comment "We, human beings, are guests of the world's *flora* and *fauna*." Dr Velayutham also thanked Dr Bala Ravi for his painstaking efforts, extending over many months, in organizing this consultation. "Many other staff members of MSSRF and IPGRI have also contributed to the success of this consultation and they all deserve our thanks."

Participants leaving the meeting.

Abbreviations and Acronyms

ALV	African Leafy Vegetables
BD	Biological Diversity
CBD	Convention on Biological Diversity
CGIAR	Consultative Group on International Agricultural Research
CGN	Centre for Genetic Resources
CIDA	Canadian International Development Agency
CINE	Centre for Indigenous Peoples' Nutrition and Environment
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GFAR	Global Forum on Agricultural Research
GFU	Global Facilitation Unit for Underutilized Species
GRFA	Genetic Resources for Food and Agriculture
GTZ	German Technical Cooperation
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFAD	International Fund for Agricultural Development
IPGRI	International Plant Genetic Resources Institute
IPR	Intellectual Property Rights
ITDG	Intermediate Technology Development Group
MDG	Millennium Development Goal
MSSRF	M.S. Swaminathan Research Foundation
NDTV	New Delhi Television
NFR	Novel Food Regulation
NGO	Non-Governmental Organization
PGRFA	Plant Genetic Resources for Food and Agriculture
PPVFR	Protection of Plant Varieties and Farmers' Rights Act
PROINPA	Promocion y Investigacion de Productos Andinos
R&D	Research and Development
SDC	Swiss Agency for Development and Cooperation
UNDP	United Nations Development Programme
VAD	Vitamin A Deficiency
WHO	World Health Organization

UN Millennium Development Goals
Five years later

Agricultural Biodiversity and Elimination of Hunger and Poverty

The Chennai Platform for Action

FOREWORD

This booklet presents the 'Chennai Platform for Action' to enhance the contribution of plant genetic resources to meeting the Millennium Development Goals (MDGs), especially to reducing hunger and poverty.

The action plan was developed by participants at an international consultation on 'The Role of Agricultural Biodiversity in Achieving the Millennium Development Goal of Freedom from Hunger and Poverty', held in Chennai, India, in April 2005. The Consultation, organized by the International Plant Genetic Resources Institute (IPGRI), the Global Facilitation Unit for Underutilized Species (GFU) of the Global Forum on Agricultural Research (GFAR) and the M.S. Swaminathan Research Foundation (MSSRF), brought together some 100 policy-makers and experts with varied backgrounds from 25 countries around the world to formulate approaches to maximize the contribution of agricultural biodiversity to reducing hunger and poverty.

Participants underscored the unique contribution that agricultural biodiversity makes to improve livelihoods though providing a foundation for household food and nutritional security and offering opportunities for income generation. They also addressed policies, institutional constraints and other issues that challenge the full deployment of these natural resources and hence limit the achievement of the MDGs. They also conveyed concern at the rapid loss of these resources seriously threatening the food and nutritional security of future generations. The intention of the participants was to draw greater attention of policy-makers globally and the international community to the role of agricultural biodiversity in the fight against hunger, poverty and malnutrition and to seek greater international commitment to conservation and use of this natural resource for achieving the first of the MDGs.

The action plan described in this booklet is intended to help national governments and international agencies to achieve the goal of halving hunger and poverty by 2015. It promotes the principles of giving agricultural biodiversity greater importance in national and international development strategies and creating the required enabling policy conditions for the sustainable utilization of this treasure for the benefit of the poorest and marginalized members of our society. The action plan calls for increased international collaboration in the conservation and sustainable and equitable sharing of the benefits arising from the use of agricultural biodiversity. It underlines the urgent need for action in nationally appropriate ways for meeting the MDGs.

The participants of the meeting were concerned about the fact that, five years after the adoption of the MDGs, little progress has been made towards eliminating hunger and poverty. In some countries, the situation has even worsened. The

meeting agreed to make all efforts to bring the recommendations made in this action plan to the attention of the Heads of States and Governments who will meet in September 2005 on the occasion of the United Nations General Assembly that will review the progress made towards achieving the MDGs. It is the sincere hope of the participants of the Chennai Consultation that the proposed action plan will be considered by the UN General Assembly when defining the next steps towards the achievement of the MDGs.

The Chennai Consultation and production of this booklet were sponsored by the Canadian International Development Agency (CIDA), Ford Foundation, the International Fund for Agricultural Development (IFAD), the Swiss Agency for Development and Cooperation (SDC) and the Syngenta Foundation for Sustainable Agriculture. We wish to take this opportunity to thank these donors, without whose generosity the holding of this meeting and the development of this action plan would not have been possible.

Emile Frison
Director General, IPGRI

Olanrewaju Smith
Executive Secretary, GFAR

M.S. Swaminathan
Chairman, MSSRF

UN Millennium Development Goals
Five years later

Agricultural Biodiversity and Elimination of Hunger and Poverty

The Chennai Platform for Action

P. Bordoni/GFU

1. From the earliest days of domestication of plants for human use about 12 000 years ago, agricultural biodiversity has played a pivotal role in sustaining and strengthening food, nutrition, health and livelihood security all over the world. In spite of enormous progress made in enhancing crop productivity through Mendelian and more recently molecular breeding, more than 800 million children, women and men go to bed every day under-nourished. The majority of them are in South Asia and sub-Saharan Africa, areas of the globe that are rich in endemic agricultural biodiversity. Reducing hunger and poverty by half by the year 2015 is the first of the UN Millennium Development Goals (MDGs), which represent a global common minimum programme for universal human security and well-being. An assessment made five years after the adoption of the MDGs indicates that progress in reducing hunger and poverty is inadequate. It is in this context that the conclusions of an international consultation on the role of agricultural biodiversity in achieving a sustainable end to hunger and poverty, recently held at Chennai, India, assume significance.

2. Endemic hunger caused by protein-energy malnutrition, hidden hunger caused by deficiencies of iron, iodine, zinc, Vitamin A and other micro-nutrients in the diet, and transient hunger caused by drought, floods, and other natural disasters can be overcome through an integrated strategy for the conservation and sustainable and equitable use of agricultural biodiversity. Even during the titanic tsunami of 26 December 2004, land races of rice were found in coastal Tamil Nadu, India, which could survive seawater inundation. Many life-saving crops, like tubers and legumes, were cultivated in the past and we urgently need to rekindle such dying wisdom and take steps to save vanishing crops, which can help to heal the wounds inflicted by natural or man-made calamities. Women, in particular, are holders of such traditional knowledge and the critical role of women in the

J. Manrique/CIP

conservation and sustainable management of agricultural biodiversity needs to be strengthened and revitalized. Tropical fruits, beta-carotene-rich sweet potato and other vegetable crops can help to fight Vitamin A deficiency in children. In other words, agricultural biodiversity provides uncommon opportunities for developing decentralized and locale-specific community food security systems involving field gene banks, seed banks and grain banks developed and managed by local women and men. This approach will further help to enlarge the food security basket by including nutrition-rich but under-utilized crops. This is the most sustainable and affordable pathway to achieving the MDG in relation to elimination of hunger and poverty.

3. Agricultural biodiversity offers the crucial raw material for improving in perpetuity the productivity and quality of crops, livestock and fish. Goals such as 'health for all' and 'fish for all' can be achieved only by conserving medicinal plants and genetic diversity in fish. Agricultural biodiversity also offers opportunities, especially to the landless poor, for entrepreneurial initiatives, which will generate employment and income from a range of value-added foods, medicines, nutraceuticals, bio-fuel and other products. Such opportunities are of particular value, since today inadequate income and purchasing power are the major causes of food insecurity at household level. The potential of agricultural biodiversity for coping with climate change is not well appreciated. In short, the flagship role played by agricultural biodiversity in overcoming hunger in an environmentally, economically and socially sustainable manner is yet to be widely realized and integrated with national and global strategies for achieving the MDGs. Better nutrition is also vital for fighting pandemics like HIV/AIDS and tuberculosis, since a drug-based approach alone will not lead to the desired results. The health foods of tomorrow will be mostly the under-utilized crops of today.

4. Agricultural biodiversity and cultural diversity have feedback relationships. Local farming systems provide the feedstock for poems, songs, dance and drama. Community-led food security systems based on the conservation, cultivation and consumption of local foods thus help to preserve cultural and ethnic diversity in crop and culinary preferences. Thus, agricultural biodiversity confers multiple benefits—ecological, economic, nutritional and cultural.

P. Bordoni/GFU

5. Taking cognizance of these unique strengths of agricultural biodiversity, the participants[1] at the International Consultation held on 18-19 April 2005 adopted the following Chennai Platform for Action for a Hunger- and Poverty-Free World. The Platform for Action is designed to assist national governments and international agencies to achieve as soon as possible the UN MDG relating to halving hunger and poverty by 2015 which therefore should:

I. Recognize that incorporation of agricultural biodiversity conservation and sustainable use in national development plans, such as Poverty Reduction Strategies, along with the creation of cross-sectoral linkages and coherence among concerned ministries at national level, is important for the delivery of this MDG.

II. Agree to incorporate agricultural biodiversity in the implementation of existing global policy tools, such as Food-Based Dietary Guidelines and the WHO/FAO Global Strategy for Diet, Physical Activity and Health.

III. Introduce legislative measures to use land and other natural production resources to enhance the ability of all to make use of agricultural biodiversity and its associated traditional knowledge for promoting off-farm employment and income generation in harmony with traditional rights, cultural identity, ecosystem integrity and gender equity.

IV. Strengthen the multilateral system of exchange provisions of the FAO International Treaty on Plant Genetic Resources for Food and Agriculture to expand its coverage of plant species important to food security and income generation for the poor, while ensuring fair and equitable benefit-sharing of commercial gains accrued

[1] About a hundred experts and policy makers with varied backgrounds from 25 countries took part in an International Consultation at the M.S. Swaminathan Research Foundation in Chennai, India, on 18 and 19 April 2005. Our task was to consider how agricultural biodiversity can help the world to achieve the Millennium Development Goals, and in particular the goal of freedom from hunger and poverty. This was jointly organised by M.S. Swaminathan Research Foundation, the International Plant Genetic Resources Institute and the Global Facilitation Unit for Underutilized Species in cooperation with the Swiss Agency for Development and Cooperation, the Canadian International Development Agency, the International Fund for Agricultural Development, Ford Foundation and Syngenta Foundation for Sustainable Agriculture.

P. Bordoni/GFU

from accessed genetic resources, and work towards a similar treaty on multilateral exchange of animal genetic resources relevant to food and agriculture.

V. Recognize and reward the invaluable contributions of rural and indigenous people, particularly women, in the conservation and enhancement of agricultural biodiversity and confer social prestige and economic benefit to its primary conservers.

VI. Promote local markets and facilitate access to international markets for the products of agricultural biodiversity, especially traditional and functional foods, ensuring equity and fairness amongst all participants.

VII. Advocate and strengthen national nutrition literacy through participatory knowledge management involving all societal segments, particularly women and young people, and train agricultural extension workers and health and nutrition professionals in the importance of dietary diversity and evidence-based beneficial effects of traditional foods to re-establish the relevance of regional agricultural biodiversity in fighting hunger and poverty.

VIII. Ensure that food and nutrition support safety net programmes, especially food aid and school feeding programmes as well as food banks, are fostering greater dietary diversity by broadening the food basket with more indigenous crops as part of national nutritional policy.

IX. Restructure research and development priorities to enhance productivity, profitability and value-chain development of a wider range of agricultural biodiversity, including hitherto neglected species, thereby generating an economic stake in their conservation.

X. Bring in change in mind-set to prevent the perennial loss of vanishing crops and dying wisdom through international initiatives to change the public image of under-utilized and orphan crops by steps such as re-designating 'coarse cereals', where appropriate, as 'nutritious cereals' and classifying a wide range of leafy vegetables, tubers, grain legumes and tropical

fruits as 'health foods'. Saving plants for saving lives and livelihoods should become everybody's business, thereby leading to a global 'agricultural biodiversity for human security' movement.

The global struggle against poverty and hunger cannot be won now or in the long run without increased international collaboration in the conservation and sustainable and equitable use of agricultural biodiversity. International commitment is imperative for actions on some of the recommendations listed above, while national initiatives can act upon others. We urge all to employ those approaches and practices that are most relevant in their individual situation and to put in place their own detailed plans to make better use of agricultural biodiversity to achieve the Millennium Development Goal on hunger and poverty. The fact that, five years after the adoption of the MDGs, most developing nations are unable to make proportionate progress in the elimination of hunger and poverty indicates that a 'business as usual' approach will not help us to achieve the goal of a hunger-free world. Equally concerning is the human population growth rate, which continues to exceed the growth rate in food production, aggravating poverty-induced endemic hunger. Where hunger rules, peace cannot prevail. Hence, the time has come to embrace the idea of a decentralized and community-managed sustainable nutrition security system based on expanded agricultural biodiversity.

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ANNEXES

List of Annexes

Annex 1: Full texts of Addresses by Dignitaries at the Inaugural Session

- Welcoming Address by Dr M. Velayutham, *Executive Director*, MSSRF
- Welcoming Address by Dr K. Atta-Krah, *Deputy Director-General*, IPGRI
- Welcoming Address by Dr O. Smith, *Executive Secretary*, GFAR
- Presidential address by Prof M.S. Swaminathan, *Chairman*, MSSRF
- Special address by Dr E. Frison, *Director-General*, IPGRI
- Keynote Address by Dr R.D. Cooke, *Director, Technical Advisory Division*, IFAD
- Keynote Address by The Hon K. Pandurangan, *Minister of Agriculture, Tamil Nadu, India*
- Inaugural Address by The Hon E. Debrah, *Minister of Food and Agriculture, Ghana*
- Vote of Thanks by Dr S. Bala Ravi, *Consultation Organizing Secretary, MSSRF*

Annex II: Full texts of Presentations

- Leafy vegetables to enhance nutritional security in sub-Saharan Africa *by R.K. Oniang'o, K. Shiundu, P. Maundu and T. Johns*
- Asian tropical fruits deliver social and economic benefits *by K.Md. Tahir and Y. Ahmad*
- Andean grains and tubers: ancient crops for better livelihoods today *by J.G. Blajos Kraljevic*
- Managing biodiversity for improved community well-being *by Setijati D. Sastrapradja*
- The Market Map: a framework for linking farmers to markets *by A. Giffith, M. Albu and A. Rob*
- Marketing biodiversity and benefit-sharing: a product development perspective *by N.P. Louwaars and B.Visser*
- International policies dealing with biodiversity and their impact on the achievement of the Millennium Development Goals *by M. Hermann, G. Moore and M. Halewood*
- Indian legislation on biodiversity *by M.S. Swaminathan*
- Protecting and strengthening local food systems: harnessing biodiversity and indigenous knowledge for food security, livelihoods and nutrition *by L. Bhattacharjee, F. Egal, L. Collette, B. Burlingame, B.K. Nandi and H. Kuhnlein*

Annex III

- SESSION IV: THE WAY FORWARD
  Participants' interaction to provide input to the finalization of the Draft Recommendations and Plan of Action

Annex IV

- SESSION V: CLOSING AND WRAP-UP SESSION
  Full texts of closing speeches

Attachments

l. Agenda for the Consultation

2. List of participants

ANNEX I

Full texts of Addresses by Dignitaries at the Inaugural Session

INAUGURAL SESSION

Chair: Prof M.S. Swaminathan, Chairman, National Commission on Farmers, Government of India

Welcoming address

by Dr M. Velayutham, *Executive Director, MSSRF*

Respected Chairman, Prof Swaminathan, past president of the International Union for the Conservation of Nature and Natural Resources, current president of the National Academy of Agricultural Sciences, India, and Chairman of National Commission on Farmers, Government of India; Dr Frison, Director General of the International Plant Genetic Resources Institute; Honourable Ministers of Agriculture from Ghana, Sri Lanka, and Kenya; Honourable Minister of Agriculture of the Government of Tamil Nadu; distinguished representatives from international organizations including the International Plant Genetic Resources Institute; the International Fund for Agricultural Development; the Food and Agriculture Organization of the United Nations; the Swiss Agency for Development and Cooperation; the Global Forum on Agricultural Research; the German Technical Cooperation Mission; the Syngenta Foundation for Sustainable Agricultural Development; the Italian Academy of Sciences; ICRISAT; Members of the diplomatic corps from several countries; distinguished representatives from 25 countries; Professor Chopra, Honourable Member of the Planning Commission, Government of India; invited delegates and members of self-help groups from different parts of India; members of the international and national Press and Media; ladies and gentlemen.

On behalf of the Chairman, the Board of Trustees, and the Staff and scholars of the M.S. Swaminathan Research Foundation, I have great pleasure in extending a very warm welcome to one and all of you and particularly to the dignitaries sitting at the high table, for participating in this international consultation on how agricultural biodiversity can help the world to achieve the United Nations Millennium Development Goal number one, of freedom from hunger and poverty. We are happy to host this consultation in association with the International Plant Genetic Resources Institute and the Global Facilitation Unit for Underutilized Species, on more than one count.

India is considered to have two of the world's 12 mega biodiversity centres, including a rich ethnic and cultural diversity. Here nature and culture have intertwined down the ages. In fact, in one of our scriptures, it is said that a great saint called one of his disciples and asked him to go out and fetch a useless plant. After extensive search, the exasperated disciple came back empty-handed and told the *Guruji*, the sage, that he couldn't find any plant that was useless. This sums up the value attached to the biodiversity and the ethos of the conservation of Nature that this great land has inherited from time immemorial.

Soon after India became a signatory to the Convention on Biological Diversity in 1992, the M.S. Swaminathan Research Foundation made pioneering efforts in organizing a series of national consultations which have resulted in two publications – Farmers' Rights and Plant Genetic Resources Recognition and Reward, in 1995, and Agro-biodiversity and Farmers' Rights, in 1996, both edited by Professor Swaminathan. This, and our public policy advocacy, resulted in the formulation of two legislations by the Government of India, namely, the Protection of Plant Varieties and Farmers' Rights Act 2001 and the Biological Diversity Act 2002. With the National Biodiversity Authority now in place, the Biological Diversity Act has become operational. Gnome Clubs and Nature Clubs in schools and colleges and Peoples' Biodiversity Register at village level are our promotional efforts to spread the genetic and legal literacy.

Biodiversity conservation, revival of cultivation of neglected and under-utilized crops, their value addition and linking these to enhanced livelihood opportunities and poverty reduction have formed one of the core areas of action research of this foundation since the 1990s at three sites – namely, Wayanad in Kerala, Kolli Hills in Tamil Nadu and Jeypore in Orissa. The Scarascia Mugnozza Community Gene Bank established at this foundation in 1994, with the generous assistance of the Government of Italy and, later, the Swiss Agency for Development and Cooperation, is a novel institutional mechanism for operationalizing access and benefit sharing, prior informed consent, material transfer agreement and providing authentication, reward and recognition to the rural and tribal primary conservers who have remained for too long unnoticed, unsung and unhonoured.

Our Honourable Minister of Agriculture of the Government of India was to participate at this Consultation, as was also our Honourable Prime Minister, but due to the parliamentary session, as well as the visit of the President of Pakistan to India, we are unable to have them with us. The Prime Minister of India has kindly sent a message wishing the consultation success. I am happy to read a few lines from his message, a copy of which is included in your docket:

"I am happy that an international consultation is being held to develop an action plan for promoting local level community-centered food and health security systems based on the cultivation of a wide range of food crops – vegetables, fruits and medicinal plants. I hope that the action plan developed at this consultation will be widely adopted, since the eradication of hunger and poverty must receive over-riding priority in public action and investment. Every child, woman and man must have an opportunity for a productive and healthy life. This will be possible only if we integrate frontier science and technology with traditional wisdom and associated cropping patterns."

Ladies and gentlemen, we hope that this consultation and the emerging recommendations will lead to a community-centered global action plan for accelerated efforts in biodiversity conservation as a bedrock for both food and nutrition security and dietary diversity, and also as a buoyant feedstock for the biotechnology industry all over the world.

Once again, on behalf of the Foundation, I extend a very hearty and warm welcome to one and all and wish you a very pleasant and productive stay at this campus and in the city of Chennai. Thank you.

Welcoming address

by Dr K. Atta-Krah, *Deputy Director General, IPGRI*

Mr Chairman, Professor Swaminathan; Excellencies; The Hon Thiru Pandurangan, Minister of Agriculture, Tamil Nadu; The Hon Ernest Debrah, Minister of Food and Agriculture, Ghana, Distinguished and Honored Guests at the High Table, Fellow Stakeholders in global agricultural biodiversity, Ladies and Gentlemen:

This is a significant moment for me, personally, for a number of reasons.

First of all, as some of you may know, I have only recently been appointed Deputy Director General of the International Plant Genetic Resources Institute (IPGRI). I am yet to take up the position in a formal sense, but as you can see, the work seems to have already begun for me. This brief address therefore happens to be my first official representation assignment in my new capacity. That makes this meeting very significant for me.

Secondly, this meeting is about agricultural biodiversity - a subject which I believe to be of fundamental importance to all of us gathered here in this consultation. I must say that it has also become a very fundamental passion for me but that is only since I started working with IPGRI. I keep on asking myself: if the subject is so important, why was it not so obvious to me in my earlier years when I was operating within agriculture but outside the framework of genetic resources institutions. That tells me that often those of us who are directly involved with genetic resources and biodiversity make the mistake of thinking that the whole world sees things the same way as we see them. That, unfortunately, is not the case. Those of us who are in genetic resources therefore need to work harder in order to broaden understanding with regard to issues of biodiversity and work towards revealing the appeal and significance of the subject for development.

Thirdly, my being here is also significant, because this event is happening at the M.S. Swaminathan Research Foundation. I have been associated with Prof Swaminathan in different dimensions for some time, and I have known him to be a man whose zeal, commitment and devotion to farmers and the course of food security and biodiversity is unquestionable. I remember that, during the World Summit on Sustainable Development, when we organized a special session on agricultural biodiversity, it was Prof Swaminathan we turned to, to give the keynote address. Recently, I was once again privileged to work with Prof Swaminathan during the World Agroforestry Congress in Orlando, Florida. He has been indefatigable working towards the elimination of hunger and poverty in the world, and I therefore take this opportunity to salute him for his achievements. Prof Swaminathan, I wish you continued good health and many more fruitful and happy years.

Now I will say a few words about my organization, the International Plant Genetic Resources Institute (IPGRI), which is an independent international scientific organization that seeks to advance the conservation and use of plant genetic diversity for the well-being of present and future generations. IPGRI is one of 15 Future Harvest Centres supported by the Consultative Group on International Agricultural Research (CGIAR) - an association of public and private members who support

efforts to mobilize cutting-edge science to reduce hunger and poverty, improve human nutrition and health, and protect the environment.

Agricultural biodiversity is the major focus of IPGRI's mandate. Our work has evolved from an almost exclusive focus, in the early years (IBPGR), on the need to collect and conserve germplasm of agricultural biodiversity, to a presently expanded focus on the management of diversity and its use in addressing contemporary development challenges – especially those of food and nutrition security, poverty alleviation and environmental heath.

Recently, IPGRI has embarked on a new strategy, in which we have identified four main Programmes as forming the cornerstone of our work. These are:

1. Diversity for Livelihoods
2. Understanding and Managing Biodiversity
3. Commodities for livelihoods
4. Global Partnerships

IPGRI has no laboratories or field sites of its own. We work with partners, levering our funds and expertise to perform our work efficiently while at the same time helping to develop capacity in others. We seek two kinds of outcomes from all our collaborations: the results of the research itself, and also the enhanced ability of all concerned to contribute to such efforts in the future. Partnerships are key to our operations, and it is in this context that we are involved in this event with MSSRF, GFU and other partners.

Our ambition is to remain a significant player in global efforts to make more effective use of agricultural biodiversity for development, using our special strength in plant genetic resources as the platform for extending into other areas of innovative research.

It is in this regard that we are involved with the present international consultation. We are very happy to be a partner with all of you in this initiative. We are also very thankful to all the donor agencies that have supported the initiative. On our part, we can say that we are fully committed to work with all of you in following through the recommendations that will come out of this consultation. The keywords for all of us needs to be *significance* and *purpose*. We all need to work together to ensure that this does not just end with a report but that it leads to the emergence of action along the development pathway. I wish the consultation the best of everything, and I look forward to being part of this history of the future.

Mr Chairman, Ladies and Gentlemen,

Thank you.

Welcoming address

by Dr O. Smith, *Executive Secretary, GFAR*

Professor Swaminathan, Members at the distinguished high table, ladies and gentlemen, I bring you greetings from the Global Forum on Agricultural Research,

an organization dedicated to the promotion of partnerships among all of its stakeholders involved in agricultural research for development.

Those of you who have been on either side of the divide, either as researcher on the one side, or as a farmer, an NGO or a community-based organization member on the other, would understand and appreciate the value of partnerships among all of those stakeholders as they work together to tackle all of our problems facing the agricultural sector. Without such collaboration, the goals of improving food security, alleviating poverty and rationally managing our natural resources, will not be achieved.

Before I say some more words about my organization, let me share a few thoughts with you. Recent information on how well the global community is doing with regard to meeting the Millennium Development Goals (MGDs) suggests that, although a number of countries are on track, and some others appear to be making significant progress, there is a strong chance that the global community as a whole will miss the MDG number one of reducing by half the number of hungry people and reducing absolute poverty, by several decades beyond the 2015 target. This is in spite of an abundance of raw material we could use to achieve these targets. The raw material of course is the biological diversity we are endowed with.

Recent estimates indicate that some 7,000 species of higher plants have been cultivated or collected for food at one time or another and have the potential to contribute to our food security needs. Nonetheless, only 30 of these 7000 species have performed the function of feeding the world, because they contribute 95% of our dietary energy needs. Evidence also exists that three of those 30 crops – wheat, rice and maize - which have received the greatest attention in terms of conservation and improvement - provide more than 50% of global plant-derived energy intake, even though some other crops such as cassava, sorghum, millet, beans, and plantain which serve as staples in particular regions or countries, also contribute but to a lesser extent, to the global plant-derived energy intake.

A similar trend of concentrating on and using only a limited number of available biodiversity is true of the genetic resources of livestock, aquatic and forest products.. According to information from FAO, only 30 of the 50,000 known mammalian and bird species have been used extensively in producing food and only 15 species currently account for over 90% of global livestock production.

Given the strong and well-known linkage between biodiversity, food and nutrition, we cannot continue with the current practice of over-exploiting a limited portion of our biodiversity endowment and neglecting a larger portion. Paradoxically, going either way – over-exploitation or neglect - leads eventually to the same outcome: loss of biodiversity. We therefore, need to develop strategies and activities that will better balance our resource use.

There is a large group of plant genetic biodiversity that we risk losing, over time, because of neglect, although they currently contribute, and have the potential to contribute even more, to the food security and livelihood of rural communities, especially those living in marginal or marginalized areas. This group constitutes

what we usually refer to as minor crops, under-utilised species, orphaned crops, neglected species, and so on. They are found in all regions of the world, and are rich sources of energy, proteins and micro-nutrients and can thus contribute to the fight against hunger as well as hidden hunger.

The Global Forum on Agricultural Research recognized the important role they could play in meeting local and regional food security and poverty alleviation goals, and decided during its triennial general conference in 2000 to develop a Global Partnership Programme – the under-utilized crop species programme managed by a Programme Facilitating Unit (PFU) based in IPGRI. The objective of the programme is to draw attention, through advocacy, to the plight of these crops and to the communities struggling to use them for food security and employment-generating purposes. Moreover, it is intended to provide information that could be used by scientists and policy-makers alike, to move them from the realm of neglect to one of major and mainstream biodiversity, so that they can contribute effectively to the common goals of reducing poverty and malnourishment.

By way of concluding, let me note that the Global Forum on Agricultural Research, which provides a space and opportunities for all stakeholders involved in agricultural research for development so that they can work together in strategic partnerships and alliances to find solutions to the problems of poverty, food insecurity and degradation of our natural resource base, including biodiversity, strongly endorses and supports this high panel meeting which we believe is tackling a topical issue. We are here in full force, starting with the PFU on under-utilized crop species, representatives from our various Regional Fora and the Secretariat of the Global Forum.

We look forward to fruitful deliberations whose outcome, we hope, will have some impact on the attainment of the MDGs' targets of reducing hunger and extreme poverty.

Presidential address

by Prof M.S. Swaminathan, *Chairman, M.S. Swaminathan Research Foundation*

'Biodiversity and Millennium Development Goals'

Honourable Ministers of Agriculture from Ghana, Sri Lanka and Kenya, and from Tamil Nadu; Honourable Member for Science of the Government of India's Planning Commission; Professor Chopra; distinguished participants: May I also add my words of welcome to all of you.

We are discussing the United Nations Millennium Development Goals (MDGs), which are now very well known. But in this Consultation we will be concentrating mainly on biodiversity in relation to the UN MDG number one: the eradication of extreme poverty and hunger. Poverty and hunger cannot be eradicated without education and environment protection and also without the empowerment of women. So, in some respects, all the MDGs are inter-related.

That is why I would like to refer to the MDGs as a 'Global Common Minimum Agenda for Remembering our Humanity'. It is a common minimum agenda for sustainable human security and well-being. We cannot go below this. This year is the International Year of Physics, to honour the discovery of relativity by Albert Einstein. In 1955, Albert Einstein and Bertrand Russell called upon the world to "remember your humanity and forget the rest. If you can do so, the way is open to a new paradise; if you cannot, there lies before you the risk of universal death". In the same vein, we need to achieve this global common minimum agenda of reducing hunger by half, by 2015, which is a very modest target, considering the fact that 500 million fellow members of the human family will still go to bed hungry in 2015.

According to the latest FAO statistics and recent global hunger map, sub-Saharan Africa and South Asia, including India, are the major hunger hotspots of the world. A series of task forces were set up to help develop a strategy for achieving the MDGs. They were coordinated by Prof Jeffrey Sachs of the Earth Institute, Columbia University. I happened to be co-Chair of the Task Force on Hunger, along with Dr Pedro Sanchez of the United States. The Task Force met in this same hall where we are meeting today, and in our report we said '*halving hunger can be done*'. In order to achieve this, we recommended seven basic and important steps.

The very *first* step is political commitment and action. I am happy that several Honourable Ministers are present here. More and more democratic systems of governance are becoming the rule rather than the exception in the world and in a democracy the political leadership will have to set the goal. The s*econd* step is to reform policies and create an enabling environment. *Third*, increase the agriculture productivity of food-insecure farmers. Because, in developing countries, farmers constitute 70% of the population: hence, they are the dominant segment among consumers - unlike in industrialized countries, where only 3 to 4% are farmers and the rest are consumers of farm produce. This highlights the importance of enhanced small farm productivity. *Fourth*, improve nutrition for the chronically hungry and vulnerable. *Fifth*, reduce vulnerability of the acutely hungry through protective safety nets. *Sixth*, increase incomes and make markets work for the poor (you will see some examples at the exhibition organized along with this Consultation). And finally, *seventh*, restore and conserve the natural resources essential for food security.

MSSRF and WFP (India) have carried out a detailed analysis of the food insecurity situation in India. It has three components – food insecurity in urban India and in rural India, and sustainability of food security. Food security is estimated using indices of productivity, land, water, biodiversity and climate. We have taken food security in terms of availability of food - which is a function of production; access to food - which is a function of purchasing power, jobs or income; and absorption of food - which is a function of environmental hygiene, clean drinking water and primary health care. Similarly, hunger can be chronic - which is poverty-induced; hidden - which is caused by micronutrient deficiencies; or transient - arising from civil conflicts or natural disaster.

Already there has been mention of the shrinking food basket, with four to five crops increasingly dominating the world's food basket. This is a very dangerous situation. If a new pest or new disease were to arise, it can become a Pan-African and Pan-World disease. Already some new virulent races of leaf rust have been recorded in wheat and late blight in potato. The US National Academy of Sciences has published a series of books on 'Lost crops', containing very interesting information not only in terms of what crops were grown in the past for food and health security but also their nutrition component - particularly, the content of iron, iodine, calcium, manganese, etc. Many of these under-utilized crops, such as millets, are often referred to as 'coarse' cereals. In fact, FAO should change this terminology to 'nutritious' cereals. That in itself will change the mindset. Coarse cereal is a very wrong terminology from the nutritional standpoint. The same is true in the case of Africa's lost crops. Several of them are very rich in iron and calcium. Hence, the revitalization of earlier food habits could lead to strengthening food and health security.

I wish to thank Dr Rodney Cooke and IFAD, and IPGRI for initiating a global project on under-utilized crops. The strengthening of this project is vital for achieving the United Nations MDG number one.

There is enormous intra-specific variability in nutritional and medicinal properties. For example, the 'njavara' rice variety is used in Ayurveda, a traditional Indian healthcare system. In other words, very valuable germplasm, both at species and intra-specific level, need conservation. Also, the CGIAR has put out a very timely publication on healing wounds – the importance of biodiversity for rebuilding agriculture in countries affected by conflicts and natural disasters. The MSSRF film entitled "*We shall Overcome*" shows land-races of rice which escaped the tsunami attack - these could help to heal the damage to soil health, caused by seawater ingression and inundation. Similarly, mangrove forests serve as bio-shields and help to minimize dangers arising from cyclones and coastal storms.

We must mainstream nutrition in the design of farming systems, particularly in arid and semi-arid areas. As a result of the IFAD-IPGRI-MSSRF project, a large number of earlier cropping systems have been revitalized. They are very good for soil health, for human health and for animal health. It is a win-win choice for the soil, for human beings and for animals. FAO has shown once again that in countries where a very high percentage of people are involved in the manual operations of farming, such as weeding, winnowing, etc., malnutrition is high. Unless we move a large number of people from on-farm to non-farm employment, and from unskilled to skilled employment, poverty and hunger will persist. More people should move from the primary to the secondary and tertiary sectors of economic activity. In this respect, China has done exceedingly well. That is why the Chinese do not have so great a problem with hunger and malnutrition.

Among different systems of gene management (Fig 1), community conservation - involving *in situ* and *ex situ* on farm through land races and sacred groves - has been neglected. It is to give recognition **and reward to primary conservers that the concept of Farmers' Rights was developed in the FAO forum. While there is**

organized effort and support to *ex situ* gene banks and *in situ* gardens and gene banks, community conservation - traditionally managed by tribal and rural families - is left without recognition or support. We were happy when UNDP chose the community conservator families of Koraput in the Orissa State of India for the Equator Initiative Award, at the World Summit for Sustainable Development in Johannesburg. It is time that the world wakes up to the need for revitalizing the *in situ* on-farm conservation traditions of tribal and rural families. The primary conservers are invariably poor, while those who make use of their knowledge and material become rich. This is the anachronism. This is why the Farmers' Rights concept and equitable sharing of benefits are important.

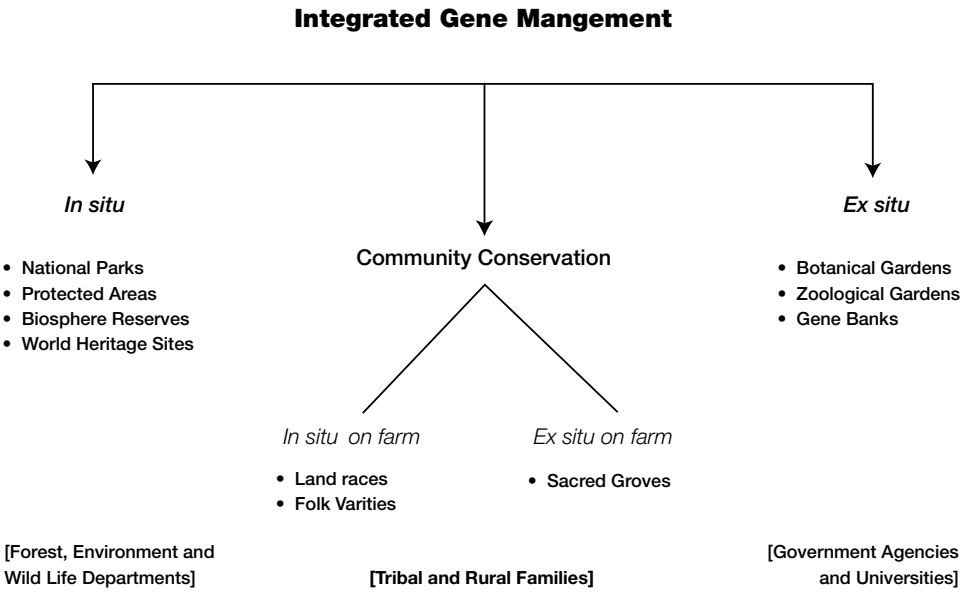

Figure 1. Gene Management Systems

Similarly, in terms of intellectual property rights, we have two kinds of rights: community rights and individual rights. Individual rights are rights such as patenting, plant breeders' rights and so on. Community rights are what we call Farmers' Rights. Farm families, particularly women, have conserved ecological, economic and spiritual keystone species for different agro-ecosystems. For example, mangrove species along the estuaries help to save lives and livelihoods. The exudates from their roots promote sustainable fisheries. Wherever there are mangroves, there are also sustainable fisheries. Similarly, *Prosophis juliflora,* a weedy shrub, has genes for drought tolerance. With the power of modern biotechnology and genetic engineering, there are no useless plants now. In fact, more than 2000 years ago, *Charaka*, the great Indian physician,

indicated that there are no useless plants - that all are useful, in one way or another. Their sustainable use is everyone's business. Nature provides for everyone's need but not for everyone's greed, said Mahatma Gandhi.

The MSSRF pathway for agro-biodiversity and sustainable nutrition and health security, as shown in Fig 2, involves conservation by local communities, genetic enhancement by participatory breeding, cultivation, value addition, market linkage and consumption. Conservation is by *in situ* on farm, organized under what we call 'field gene banks', which are linked to the *ex situ* community cryogenic gene bank. The community conservation movement practiced and advocated by MSSRF is devised to help create an economic and livelihood stake in conservation. Much of the produce is locally consumed and this is facilitated through community grain/ fodder banks. This pathway built around each community is helpful in preventing hunger in the poorest of the poor households. For such households, the grain bank lends food grain during times of distress, which the family pays back during better days of the year, with grain interest. This pathway can ensure against famine in isolated, economically-backward areas.

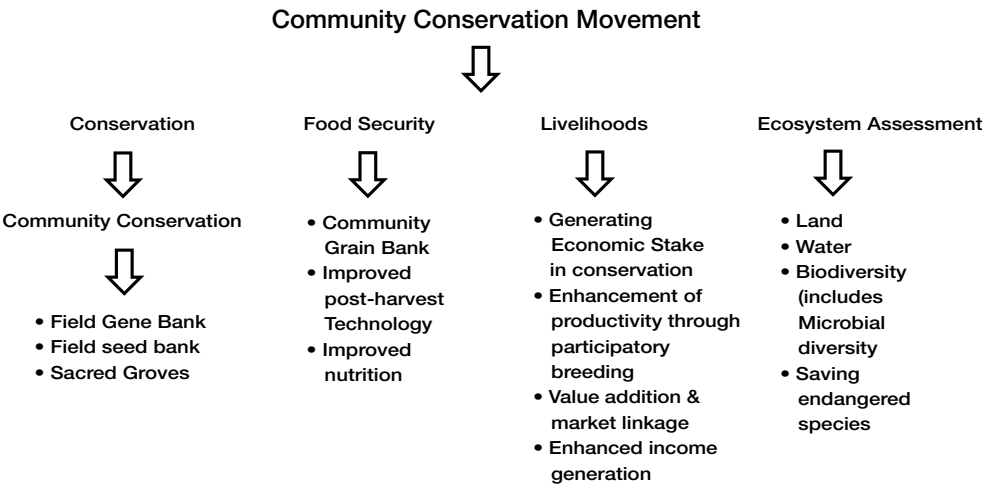

Figure 2. MSSRF Pathway for conservation of Agro-biodiversity

I would like to conclude by offering a few suggestions for an action plan that may emerge from this Consultation. *First,* launch an agro-biodiversity conservation movement and promote food-based nutritional literacy through participatory knowledge management, and enhanced productivity and profitability of under-utilized crops through participatory plant breeding and agronomy. *Second*, provide recognition and reward through a National Gene Fund. *Third*, link farming systems with functioning market chains to promote the concept of 'diversified diets for productive lives'. *Fourth*, the epicenter of hunger and poverty lies in families without

assets, who have no land, no livestock, no fishpond, etc. Therefore, opportunities for skilled non-farm employment in the areas of post-harvest technology and agro-processing assume importance. Nutritious but neglected and under-utilized crops provide opportunities for such non-farm employment in the post-harvest sector. Malnutrition-free villages could be created by organizing an integrated production - value-added processing - marketing system. The work should start from below, with a bottom up approach. While global thinking and global aims are all right, action has to be grounded at local level through an integrated production, processing, marketing and consumption system. *Fifth*, nutrition support and safety net programmes should include a wide range of crops.

It would be advisable to re-name government-supported 'food-for-work' programmes as 'food-for human-development' programmes. Food-for-work normally covers unskilled work only. We should enlarge the concept of food for human development to include skilled activities such as running crèches for children and noon-meal centres. In my view, the UN World Food Programme could spearhead this 'Food for Human Development' initiative.

Sixth, a ten-year review of the progress made in implementing the Beijing Platform for Action reveals that there is no let-up in the feminization of hunger and poverty. Hence, all nutrition support and farming systems programmes must be engendered, with priority given to 0-5 year old children and pregnant women. *Seventh*, hunger and poverty are also widespread in urban areas. Nutrition Gardens in schools, nutrition literacy and well-designed nutrition support programmes are needed in towns and cities. Civil society organizations should be mobilized for promoting balanced diets. *Eighth*, conservation and sustainable use of biodiversity provide concurrent opportunities for elimination of endemic, hidden and transient hunger. Therefore, community food and nutrition security systems based on field gene-seed-grain banks should be promoted, to begin with, in all the hunger hot spot areas. Biodiversity for productive lives and secure livelihoods should become the bottom line of all agricultural and rural development programmes.

Ninth and last, biodiversity, although legally a national heritage and asset, knows no political or geographical frontier in terms of its occurrence, spread and evolution. Martin Luther King once said, while taking his breakfast: "my gratitude goes to 50 percent of the world's farmers because some food item has come from Jamaica, something else has come from India, and so on". Therefore, we are all the beneficiaries of global biodiversity. Hence, while respecting national sovereignty with reference to biodiversity, there is need for greater international collaboration in the conservation, and sustainable and equitable use of biological wealth. Biodiversity for hunger and poverty elimination could provide a platform for partnership among all the stakeholders involved in this greatest living industry on our Planet. In order to safeguard the future of this living industry, we must safeguard our biological wealth. The goals 'food for all' and 'work for all' can become a reality if the conservation and sustainable and equitable use of biodiversity becomes central to our strategy for the elimination of poverty and hunger.

Thank you.

Special address

by Dr E. Frison, *Director General, IPGRI*

'Biodiversity and Livelihoods'

Professor Swaminathan, Honourable Ministers, distinguished guests, ladies and gentlemen: it is a real pleasure for me to be here today and to address you at the opening session of this important consultation process. I truly believe that the issue of agricultural biodiversity and its contribution to livelihoods deserves the attention that we will be giving it over the next two days. These discussions will help strengthen our efforts to harness agricultural biodiversity for the purpose of meeting the Millennium Development Goals. The message that we want to come out of this meeting is not one that focuses on what should have been done, but rather one that looks at what we can do and that shows how by pooling our efforts, we can really make a difference. I firmly believe that with the necessary collaboration and appropriate resources, the millennium development goals can be achieved. It is up to us to work together to make that come true.

To begin with, what exactly are we talking about when we speak about agricultural biodiversity? In very simple terms, we know that agriculture is what feeds us, but agricultural biodiversity is what sustains us; it is what makes the whole effort sustainable. We are also talking about different components of agricultural biodiversity; we are not just talking about the crops or the animals themselves - these are the managed component - but also about the unmanaged components, such as pollinators, microbes, the forest environment and biological control agents. These interact with the managed component and are essential to the success and sustainability of an agricultural production system. Diversity occurs at three different levels. First, there is the diversity of ecosystems, the different environments in which farmers are able to grow their crops. Then there is the diversity of species contained in these ecosystems - in this case, the different crops that a farmer chooses to grow. And finally there is the genetic diversity within species, which is what allows us to make improvements. For millennia, this diversity has provided farmers with the raw material they needed to domesticate their crops and to select more productive crops and animals. Biodiversity can contribute to human well-being in several ways.

We know that biodiversity can deliver. The classical example of improving an agricultural production system through simplification is not the only model we can follow. We know that biodiversity can contribute to more than just food production and I will briefly cite a few examples here. Ecosystem services provided by agricultural biodiversity are estimated to be at least three times the value of agricultural production itself. And yet, these are values that are neglected in economic evaluations of work on biodiversity. Genetic diversity is the foundation of all improvements and therefore we must make sure that this diversity remains available for future improvements. We do not know what challenges the future will bring in terms of biotic or abiotic stresses and what will have to be overcome in order to maintain an increase in productivity. But we must also see how diversity can contribute to improved productivity today by providing greater yield stability,

pest and disease control and sustainability. I will give a few examples of this in my presentation.

It is very important to realize that production is fluctuating from year to year because of changes in climate. But we are also very familiar with the consequences that shocks caused by environmental conditions, such as drought and flooding and by man-made disasters such as civil strife, can have on an agricultural production system. The consequences consist of sudden and often very severe drops in production. Now, if we look at how the complexity and diversity of an agricultural production system affects its sustainability and resilience, we know that when a production system is more diverse, the drop in productivity following a shock is much smaller and the time needed to recover and to reach normal levels of production is much shorter. So, a diverse production system provides greater resistance to shock and greater resilience, improving the capacity of the production system to return to its normal state. This is very important, especially in marginal areas where farmers cannot afford to lose even one crop. In this case maximizing productivity is not the primary goal but minimizing risk is, and therefore the wise use of diversity in these production systems becomes very important.

I would like to give a few examples of recent studies that have tried to document this scientifically. For example, the work that Professor Zhu and his team have carried out on rice in China. This concerned the use of resistant hybrids inter-cropped with traditional susceptible landraces of rice and led to the re-introduction of traditional varieties which are superior from a nutritional point of view, as well as being culturally important. This study showed that even in modern agricultural production systems, the use of greater biodiversity can help suppress the need for pesticide use, and increase productivity. Similar work was done on barley in the eighties, in an effort to fight barley mildew. In England, Bullock and his colleagues experimented with species-rich and species-poor hay production systems. The results of their study showed that greater diversity in hay production doubles productivity from the second year and increases stability of production over the years. There is also a more recent example from Eritrea where *hanfetz*, a system of mixed wheat and barley, stabilized yield, increased productivity and ensured a better quality product. I could cite many more studies that came up with similar findings but we do not have time to go into that now.

We know that biodiversity can deliver. It is not just a source of traits. This, of course, remains a very important aspect of diversity but we must learn to look beyond the diversity conserved in genebanks to see how we can use the diversity contained in the field to increase productivity and to build an alternative model of intensification that is different from the model of simplification we see in industrial agriculture. In production systems, especially in marginal areas where people's main concern is to minimize risks, we can have a greater impact by making more effective use of the biodiversity that is already available, growing in the fields. At the last meeting of the Conference of the Parties of the Convention on Biological Diversity, we proposed the establishment of a facilitation unit, similar to the one we have for under-utilized species, to bring together people who take an agro-

biodiversity approach to production systems, that is to say, a more holistic and integrated approach to the use of diversity in production systems.

I would like us to take just a couple of quick glances at examples where we have shown how various elements of diversity in a production system can also contribute to increased income. When I was in China, I was able to see for myself the results of work that was being undertaken on buckwheat. Here, through partnerships between farmers, local extension agents, the private sector and researchers, we were able to significantly increase the income of farmers and their communities by making better use of buckwheat through improved seed production and training and by processing grain into flour, giving a 50% increase in productivity and income.

The second aspect of diversity that I want to talk about relates more specifically to hunger and food security but before I do that, I would like to stop and make an important point: reducing acute hunger, the hunger of people who go to bed on an empty stomach every night, remains a very important aspect of our efforts. Despite the fact that percentage-wise we have decreased the number of hungry people, we still have to deal with an increasing population and with the more than 850 million people who go to bed hungry every night.

But besides this quantitative aspect of hunger, a much neglected aspect is the hidden hunger which affects one person out of three on this planet. More than two billion people are affected to some degree by hidden hunger and malnutrition, induced by micronutrient deficiencies and imbalanced diets in general. And here also, it is women and children who are the main victims. This is about more than the better-known aspects of malnutrition, such as Vitamin A deficiency or iron deficiency, deficiencies that continue nonetheless to be huge problems. This is also about the so-called diseases of affluence or non-communicable diseases that are on the increase in developing countries. In urban areas mainly, we have an increase among poor people of heart disease, diabetes and cancer – all linked with the simplification of diets and a greater consumption of carbohydrates and fats. This is an area where biodiversity can make a significant contribution.

So, the approaches to hidden hunger that have been taken in the past essentially focused on supplementation and fortification. Of course, in some cases, supplementation is the way forward. For example, iodized salt has been a tremendous success in fighting goiter but this cannot be replicated for many other deficiencies, particularly if you want to reach poorer people in rural areas. Fortification methods have become very difficult and, for this reason, we know that the dietary diversity approach is the way forward. And yet, until a few years ago, even in nutrition circles the dietary diversity aspect was not considered to be very important. In recent times, and we recently had the United Nations Standing Committee on Nutrition that met in Brazil, the dietary diversity approach has come to be recognized as an important way forward. And so we have increasing evidence of the benefits that greater diversity in diets can have on health and productivity. We must focus on those neglected and under-utilized species, on traditional crops and varieties whose use has been decreasing. We must improve their cultivation, not only by looking at the production side but also by looking at the marketing aspect and by taking

into account the whole chain, from production to consumption. Marketing is a very important aspect of this. Other speakers have already mentioned how much the IFAD project on under-utilized species is contributing to our knowledge in this area. We know that various aspects are interrelated: biodiversity conservation and nutrition and health status are interrelated; socio-cultural traditions and income generation are interrelated; and we can create a number of virtuous circles if we promote greater use of biodiversity. We can show that greater income contributes to better health, which leads to better conservation as well as the conservation of socio-cultural traditions. By taking this approach we can create a whole new dynamic in production systems, a dynamic that will sustain itself. What will it take to meet the Millennium Development Goals? I believe that biodiversity is crucial to human survival. Agricultural biodiversity is critical for human well-being, not only from the nutrition point of view but also from the point of view of health, providing shelter, dealing with water scarcity, increasing resilience in the face of environmental changes and ensuring the sustainability of production systems. We need commitment and action in this area, to be able to deploy the full potential of agricultural biodiversity for the benefit of people and this consultation must help us to achieve that. It should feed into the United Nations Assembly assessments of the Millennium Development Goals in September, and draw the attention of decision-makers to the critical role that agricultural biodiversity has to play in meeting the millennium development goals.

I would like to finish with a quote from the Chairman, M.S. Swaminathan that 'the right to food has to become the right to *good* food'.

Thank you for your attention.

Keynote address

by Dr R.D. Cooke, *Director, Technical Advisory Division, IFAD*

Chairman Professor Swaminathan, Honourable Ministers, distinguished guests and colleagues. We have just listened to two very interesting but contrasting presentations from IPGRI. Emile Frison started by saying that biodiversity really deserves the attention we are paying to it, but his colleague, Kwesi Atta-Krah, concluded by asking if it is really perceived as being that important! Dr Frison displayed just a hint of optimism, whereas Dr Atta-Krah, his Deputy Director, was maybe responding to the more brutal reality. And that reality derives from the observation that support for agriculture has subsided considerably from 20% O.D.A in the eighties to just some 10% by the later nineties. So how can agricultural biodiversity be so important if donor support for agriculture has declined so steeply? Let me tell you, on behalf of the donors - on behalf of whom I am supposed to be emphasizing some themes - that we would promptly say this decline reflects the wishes of national governments - our partners, and that is also true. Just consider the major challenge to your ministers of agriculture, with all due respect to those who have assembled here today: they will

have had a tough battle with their ministers of finance to maintain the agriculture slice of national budgets in each country.

We have some donors here today. There is Dr Martin Sommer from the Swiss Agency for Development and Cooperation. We have Dr Andrew Bennett who knows a lot about DfID, and is now with the Syngenta Foundation, and we also have representatives from Canada and Germany. So let me tell you, without embarrassing my colleagues, that these people are often considered to be a bit eccentric because they are interested in agriculture! *However, things are changing slowly*. My President, the President of IFAD, would have wished to be here today but he has to be in Rome both today and tomorrow to Chair the meeting of our Executive Board. IFAD is unusual amongst donors in that it has agriculture in its title – International Fund for Agricultural Development. In fact, a number of our Board members had suggested earlier that we change it - reflecting ODA trends, but if President Båge were here, I know that he would have started his speech noting that three-quarters of the 1.1 billion people living in extreme poverty, live in rural areas. And most of those people are living directly or indirectly on agriculture – point number one. This is in defence of my 'eccentric colleagues' who persist in talking about agriculture! *Things are changing*. Just two weeks ago, I was in the World Bank for their Rural Week, and the outgoing President and, hopefully, also the recently-appointed one, are observing the increasing emphasis on rural development.

Now the people living in the rural areas often hold the frontlines against natural resource degradation, desertification and biodiversity. They are the 'stewards' of our natural resources, so to speak. They are essential players in translating local efforts to confront poverty into global environmental benefits.

The speaker before me mentioned the World Summit on Sustainable Development, where Professor Swaminathan, IFAD's President and myself were together on a panel. One of the points they made is that rural people hold the key to sustainable use of land and water and the other resources upon which their future – and ours, too - also depends.

Household food security in poor marginal areas of the developing world still depends on a wide variety of crops, as we have heard. The importance of which, I have to say, is not generally recognized in the international development and research community - leaving aside some core centres such as IPGRI, of course! And, as Emile Frison just reminded us, many of these crop species occupy important niches and are adapted to the risky and fragile conditions of many rural communities.

I would like to divide what I am going to say now into two themes - first of all, biodiversity as regards sustainable farming systems and, secondly, biodiversity and nutrition.

Biodiversity as regards sustainable farming systems

Clearly, for sustainable farming systems, we require a broad portfolio of crops to meet the diverse environmental conditions and markets. As the Chairman reported, some of these key resources are already in the hands of the rural poor in the form of a wide range of neglected crop species. And may I thank Emile Frison for that nice

diagram showing how diversity is a key factor in the stability of many of those agro-eco systems.

However, these locally-important species are frequently neglected by both the research community and the development community, alike. But you will have heard one or two mentions of IFAD-financed programs, and for IFAD, biological diversity has long been recognized as a gateway to empower poor rural people to overcome their poverty. This is because we see plant genetic resources, together with related knowledge and informal institutions, as being key assets of the poor, to be built upon and leveraged towards those Millennium Development Goals.

A number of IFAD programmes have contributed to the identification and diversification of market opportunities for minor crops and supported the development of commodity chains likely to enhance the demand and use of under-utilized species. I will just mention three of those examples - one is the use of the under-utilized species in Central and West Asia, North Africa and Latin America. That is a programme involving an alliance of NGOs, IPGRI, the private sector and the national agricultural research systems. And the focus has been appropriate processing technologies, commercialization and marketing strategies that have been tested to raise small farmers' incomes and strengthen their food security. And what we refer to here are the following cases: in Egypt and Yemen, medicinal and aromatic plants; in Latin America, Andean grain crops and, as Professor Swaminathan mentioned, in India, millets. And in your folders you have a rather nice brochure from the Swaminathan Foundation, regarding the role of minor millets in income generation – a case study. In one of the breaks, I would certainly recommend that you have a look at it. Similarly, there is an interesting folder from IPGRI, entitled "Neglected no more – two years later". It sounds like a sound-bite by a politician. Again, the sound-bite perhaps errs on the side of optimism - "neglected no more", because I also recall Professor Swaminathan writing in another leaflet "Dying Wisdom and Vanishing Crops". So, let us not be too complacent: maybe these crops are not quite so neglected but still, as Kwesi Atta-Krah told us, a lot of work remains to be done.

The second example in South Asia and the Pacific has been looking at coconut genetic diversity and the focus has been on thick shells, tender nuts, soft endosperm varieties with high oil content. But the focus is very much on village industries - how to generate increased income and increased farming system productivity.

The third example has been the work with FAO and IPGRI in the Sahel, looking at Diversity Field Fora and Diversity Seed Fairs. And the aim of these mechanisms is to strengthen scientific and local knowledge cross fertilization, and intra- and inter-village exchanges. And more recently, this dimension has included the enhancement of farmers' political capital by improving decision making. The particular countries involved have been Mali, Burkina Faso and Niger.

I am pleased to provide details of the biodiversity-related ongoing projects financed to IPGRI by IFAD:

Empowering Sahelian Farmers to Leverage their Crop Diversity Assets for Enhanced Livelihood Strategies: This programme tests two effective instruments to enhance plant biodiversity: Seed Diversity Fora and Seed Diversity Fairs. A three-

year USD 1.3 million second phase of the programme began this year. This second phase builds on the achievements of an earlier phase.

Both the fora and the fairs have proved to be sound multi-stakeholder partnership-building approaches. They enable farmers, together with researchers, extension staff and NGOs, to better understand and strengthen the contribution of plant genetic diversity to farmers' livelihood strategies - particularly in marginal, risk-prone areas, such as the Sahel. The new programme will extend the results achieved in Mali to Burkina Faso and Niger. It has a strong capacity-building orientation - training at different levels, action-research methodologies, and support for improved livelihoods through plant biodiversity.

Enhancing the contribution of neglected and under-utilised crops to the food security and incomes of the rural poor: This USD 1.4 million 3-year programme (2002-2005) consisted of research and action programmes in Asia and the Pacific, Central and West Asia and North Africa, and Latin America and the Caribbean, to redress the neglect of valuable plant genetic resources of crops managed by the rural poor. Useful results were recorded by way of income generation through the cultivation of oregano, sage and other target species in North Sinai; processing/added value strategies to commercialize and market nutritious millet products in India/Nepal; and the development of quality standards criteria for the cultivation (including organic production) and commercialization of target crops. Hundreds of community members, particularly women, were trained in food technology, and entrepreneurs trained in marketing strategies. Cultivation manuals, recipe books, TV and radio programs, conferences, community workshops and leaflets all raised awareness on the value of target crops in addressing poverty and nutrition insecurity.

Programme for Overcoming Poverty in Coconut-Growing Communities: Coconut Genetic Resources for Sustainable Livelihoods: The goal of this three-year USD 1 million programme, approved in September 2004, is to help overcome poverty among marginalized coconut farmers in China, Ghana, India, Indonesia, Jamaica, Malaysia, Mexico, Philippines, Tanzania and Thailand, through improved coconut-based farming systems and the diversification and effective use of coconut products and by-products.

The project's main strategy is to develop sustainable models for ensuring the technical feasibility, financial viability, social acceptability and environmental safety of village-level income-generating technologies. It builds on the natural, physical, social, financial, and human capital to make promising technologies sustainable at the community level. The strategy will be tested in 2-3 coconut-growing communities in each country."

"Biodiversity, food and nutrition

Let me come to the second theme, *biodiversity, food and nutrition*. Emile Frison has just reminded us of the consultation on biodiversity for food and nutrition organized by the Convention on Biological Diversity and the last meeting was in Brazil. Action is clearly required here to counteract what that consultation described as 'simplification of diets, the simplification of eco-systems, and the erosion of food

cultures'. This is what Professor Swaminathan referred to as the shrinking of the food baskets. And this is very important, as he pointed out, because the diversity of foods from plants and animals is the preferred route for human health. Traditional food systems provide synergies between human and eco-system health and culture, and traditions offer the context for mediating those positive dietary choices.

Now, without action to directly engage the environmental, agricultural, nutritional and health communities, biodiversity - and the positive options offered by agricultural biodiversity for addressing nutrient deficiencies and the emerging burden of non-communicable diseases - will be lost.

So, let me return finally to what I said at the start. Clearly, we are convinced that agricultural biodiversity is important both for sustainable farming systems and for food and nutrition. But in order to raise political commitment and move to action, we have to come back to the priorities of national governments. And, frankly, these are not agricultural biodiversity. We have to put agricultural biodiversity in the context of economic development and poverty reduction. We have to illustrate why biodiversity is important in terms of who the rural people are and where poverty exists, and hence demonstrate how biodiversities can contribute to economic development and poverty reduction.

Thank you very much.

Keynote address

by The Hon K. Pandurangan, *Minister of Agriculture, Tamil Nadu*

Respectful Professor M.S. Swaminathan, Chairman, National Commission on Farmers, Ministry of Agriculture, Government of India; distinguished foreign delegates; honourable members of the M.S. Swaminathan Research Foundation; learned participants; ladies and gentlemen: At the outset, may I take this opportunity to convey the good wishes and warm greetings of our Honourable Chief Minister of Tamil Nadu, Dr *Puratchi Thalaivi Amma* (Ms J. Jayalalithaa) to all at this international consultation on 'the role of biodiversity in achieving the United Nations Millennium Development Goal of freedom from hunger and poverty'. I thank the organizers for giving me an opportunity to participate in this important consultation.

Coming to the motto of this conference today, I wish to emphasize that agro-biodiversity has a critical role in the food and livelihood security of billions of people, for environmental health and in industry. This important component of biodiversity has emerged and been nurtured through the knowledge and skills of the tribal and rural women and men farmers for over 12,000 years. Out of 7,000 edible plant species, 95% of the food requirements are met by only 30 species. Three cereals, rice, wheat and maize, are meeting more than half of the world's food requirements. The shrinking food basket and the extinction of crops and landraces have a direct impact on the food and nutrition security of the economically-vulnerable sections of the community.

Globally, over 800 million children, women and men suffer from total calorie insufficiency and over two million suffer from hidden hunger as a result of the lack of micro-nutrients in their diet. In Tamil Nadu, minor or nutritious millets play a vital role in the food security of the rural and tribal communities. The traditional preference for these crops is due to their hardy nature under harsh agricultural conditions and their use as a special food in women's antenatal care. Hence, several nutritious millet species are being cultivated in Tamil Nadu, in diverse intercrop systems. However, with the increased availability of other grains and poor processing technologies available to these millets, many are on the verge of extinction. In the case of small millet, *Panicum sumatrense*, there has been a sharp decline in the area under cultivation in Kolli Hills during the last half century. Some of the major reasons for this reduction are low productivity, non-availability of high yielding varieties, lack of market and market linkages and the introduction of commercial crops, such as tapioca.

In the same manner, many other crops traditionally grown for food are disappearing across the world at a fast rate. An integrated effort is necessary to arrest this trend and mainstream these crops into sustainable global food and nutrition security. A better appreciation of these by the policy makers and administrators is important so as to overarch the contributions of plant diversity in improving the livelihood of the poor. The world we live in today is threatened by climate change and declining biodiversity. We have only a little time to set up institutional and policy frameworks to counter these challenges, so as to leave a better world for future generations and to adequately address the millennium development goal. For many developing countries endowed with rich biodiversity and burdened with high poverty, support and commitment from the donor community assumes importance. The agenda to enlarge the food basket, arresting the extinction of under-utilized species, the reduction and elimination of under-nutrition, malnutrition and hidden hunger, cannot wait.

The important contribution of the M.S. Swaminathan Research Foundation in conceiving and demonstrating the strength of community grain banks for storing locally-produced grains, including under-utilized crops, and making them available to the poor, has great value in combating poverty. The government of Tamil Nadu, under the leadership of our Chief Minister, attaches high importance to the cultivation and consumption of nutritious millets. Thanks to recent endeavours, these crops are gaining importance among the urban people as health foods.

This address will be incomplete if I fail to explain to this distinguished gathering the various agricultural schemes being implemented by our Honourable Chief Minister, for the betterment and welfare of the farming community and to eradicate hunger and poverty. *"Hatra azhipasi theerthal aghthoruvan petran perul vaipudi"*, said the great Tamil poet, Thiruvalluvar. It means that by relieving people of their devastating hunger, one makes by far the most valuable investment. In reverence to this wise saying, our kind-hearted Chief Minister has been implementing many welfare schemes. I am privileged to list a few of the important schemes being implemented for the welfare of the farming community in Tamil Nadu.

A new scheme called *"Namadhu Gramam"* (our village) with an outlay of Rs. 200 crore covers all village *Panchayats* and aims to achieve comprehensive rural development, including rural employment, 100% school enrolment of the children, poverty reduction, and a reduction in infant mortality, amongst other goals. Another important scheme called *"New Anna Marumalarchi Thittam"* is aiming to eradicate poverty among agricultural labourers in rural areas. So far, 204 projects have been commissioned, with an investment of Rs.132.26 crore. The Self-Help Group movement is another major step taken by our Chief Minister to bring in prosperity with gender equity and under this movement nearly 31.43 lakh women have been enrolled in 1.87 lakh self-help groups. Similarly, our government is in the forefront with a protection scheme to enhance the status of the girl child, which has so far covered 23,004 children.

Mahatma Gandhi had envisaged an India where the poorest shall feel that it is their country, in whose making they have an effective voice - a country where all communities shall live in peace and perfect harmony. To make such an India a reality, our Chief Minister has taken various steps to develop Tamil Nadu and to enhance the living status of its people, particularly agriculturists, agricultural labourers, aged people, widows, children, orphans, the physically handicapped, the downtrodden and people below the poverty line. We are converting waste, dry and uncultivable lands to cultivable land so as to increase agriculture production, employment and tradable surplus.

"Thani oru manithanukku unavu illai enil intha jagathinai azhithiduvom" is the outburst of the revolutionary poet Bharathi Dasan. It means that this world will be destroyed if any individual cannot get food for his/her livelihood. The poet further said *"Vayitrukku sorida vendum ingu vazhtum manitharukkellam"* and that means "we should (make it possible) to feed all the people residing here". To respond to the sentiment behind these powerful sayings of *Bharathi Dasan,* the government of Tamil Nadu has strengthened the *Puratchi Thalaivar* M.G.R. Nutritious Noon-meal program in schools by adding egg, potato and pulses once a week. The annual commitment of this scheme is Rs.844.97 crore.

I conclude by wishing the best to all of you assembled here with the noblest intention of making the world hunger- and poverty-free, and once again thank the M.S. Swaminathan Research Foundation for inviting me and giving me this opportunity.

Thank you and *Vanakkam*.

Inaugural Address

by The Hon E. Debrah, *Minister of Food and Agriculture, Ghana*

Respected Chairman, Honourable Ministers of Agriculture from Sri Lanka, Kenya and Tamil Nadu, administrators, scientists, civil society groups, the media, farmers, and distinguished guests: I bring you greetings from the Government and people

of Ghana. It is my pleasure to be here with you today and tomorrow to discuss this all-important subject of biodiversity. Moreover, it is a privilege for me to deliver the inaugural address on behalf of participating countries.

Mr Chairman, as we all know, the Millennium Development Goals are the international community's time-bound and quantified commitment to cut the extent of extreme poverty around the world by half, by the year 2015. This is a big challenge for those of us from the developing countries, where poverty and hunger are said to affect about 800 million people or more. The Millennium Development Goals are therefore very critical to our respective countries' agenda for growth and prosperity. It is my understanding that all countries that signed the Millennium Development Declaration in 2000, leading to the Millennium Development Goals, have developed strategic policies, putting measures in place for achieving the said goals. In my country, we have developed the Ghana Poverty Reduction Strategy, which has put in place the necessary structures for managing the economy and building strong partnerships to put Ghana on the right track.

Undoubtedly, Mr Chairman, agriculture plays a lead role in the attainment of the objectives of the Ghana Poverty Reduction Strategy. This is because the poverty prevailing in Ghana indicates that this is a rural phenomenon and that 95% of people who live in the rural areas - and that constitutes about 65% of the national population - are engaged in agriculture. Biodiversity, which embraces a variety of forms, would be the *flora* and *fauna* that has evolved over thousands of years in a dynamic interaction between nature, and careful selection and breeding by farmers. The available landrace selections were created by farmers under intense environmental pressure and also exercising their selection pressure over a long period. However, after surviving on biodiversity for over thousands of years, biodiversity-based livelihoods and food security are now under threat. Available genetic materials are being either neglected or under utilized. Mr Chairman, at this point it is important to remind ourselves of the enormous benefits of biodiversity in areas such as nutrition, medicine, crop improvement, and environmental sustainability.

In this light, the management and use of biodiversity become critical in order to achieve the Millennium Development Goals, especially regarding the eradication of extreme poverty and the fight against hunger.

Scientists and policymakers, ladies and gentlemen, in recent decades agricultural biodiversity has diminished, as farmers increasingly rely on fewer crops. I am told that we need gene banks to protect crop diversity and make it available to future generations. This diversity is vital to winning the war against hunger and poverty, by providing the raw material necessary for farmers and breeders to develop high yielding and better quality food crops, which are vital in order to keep up with the pace of population growth.

I am also informed that crop diversity is needed to overcome major farming constraints, such as pests, diseases, weeds, drought and poor soils. Community gene banks are also necessary to help restore the agriculture of countries emerging from war, drought and natural disasters, where local communities have lost their own plants. It is noteworthy, therefore, that diverse traditional cultivars, domesticated

and conserved *in situ* on-farm by farmers over the years, have global significance because they constitute the fundamental genetic pool for modern plant breeding and for meeting the food requirements of the growing global population. Such diversity of flora and fauna not only provides the basis for our livelihoods but also remains as a cornerstone for global food security.

Mr Chairman, it is against this background that we view, with a sense of relief, the concerted efforts of institutions such as the International Plant Genetic Resources Institute to stem the erosion of crop landraces and a time-tested traditional system of managing them. Since there is a relationship between global environmental disasters and the actions of humankind, there should be a growing commitment towards taking rapid steps to address environmental problems through the preservation of biodiversity, to create a better life and to preserve our national heritage for the future generations.

This should be achieved by investing in conservation and developing our biological resources in an effort to develop our tourism industry and enhance our capacity to tap the many export markets that are not being exploited.

Mr Chairman, participating countries and, I am sure, other countries as well, are looking forward to implementing recommendations from this meeting to strengthen policies both on conservation and on the utilization of plant biodiversity, especially the endangered species, for the betterment of livelihoods.

At this point, Mr Chairman, I wish to ask a question. How and what do we need to do to ensure that the recommendations of this consultation do not end up on deaf ears? When this session began, I saw something from the film clip about the tsunami, where Professor Swaminathan says that "an ounce of action is better than a ton of theory". So, how do we bring forward the decisions that we make here?

I quote the example that if a bottle is half full, some people describe it as being half full while others say it is half empty. So all this will be easy to deal with, depending on how you put it to the politician. If you package your message to the politician in such a way that it is straight and simple, it is likely to be easy but if you make it more scientific, we will not understand and things will be different. Let me tell you, I was very undecided about attending this consultation. When the invitation came, I really did not know about biodiversity. I decided to talk to you scientists, who talk in a scientific language that is difficult for me to understand. Yesterday I was speaking to some people, including you, Mr Chairman, and you made the subject very easy for me. I got to know how serious world circumstances are right now, with regard to biodiversity. But I said to myself: right now in this world we are depending on three main grains – maize, wheat and rice. Should something happen in the world and maize and rice get wiped out, what do we have to depend on? So - package your message to us in a simple way that we can understand and the politician will have to give you all the support you need.

Mr Chairman, I have come to know that biodiversity is a global phenomenon, the benefits of which cut across borders – whether your country is rich or poor. It is significant to note that areas of rich biodiversity are areas where there are high levels of poverty. It is important, therefore, to find ways not only of sharing the goals or

the benefits of biodiversity but also the costs of maintaining global biodiversity so that all of us, including the poor, can benefit from it. How can we share the cost of maintaining biodiversity - where there is rich biodiversity?

By the time this conference ends, I hope that there will be clear-cut directions with regard to these three challenges, among others, in relation to the achievement of the Millennium Development Goals of freedom from hunger and poverty. Mr Chairman, on behalf of the participating countries, I would like to congratulate the organizers of this assembly. I wish to mention here the names of the Swiss Agency for Development and Cooperation and the Canadian International Development Agency for the support they have given for this consultation.

I sincerely hope that the final report of the consultation will provide additional momentum to the efforts of the various governments in achieving the United Nations Millennium Development Goal of freedom from hunger and poverty. On this note, and on behalf of my colleagues, Ministers and policymakers from other countries, it is my pleasure to wish you all the best for the discussions taking place today and tomorrow. May Almighty God be with us!

Vote of Thanks

by Dr S. Bala Ravi, *Consultation Organizing Secretary, MSSRF*

Chairman of the session, respected Professor M.S. Swaminathan; Honourable Ministers of Ghana, Sri Lanka, Kenya and the Indian state of Tamil Nadu; Dr Emile Frison, Director General, IPGRI; Professor Chopra, Member of the Planning Commission, Government of India; Dr Rodney Cooke from IFAD; Dr Andrew Bennet; Dr Martin Sommer; distinguished participants; ladies and gentlemen: It is my pleasant duty to place a vote of thanks to all distinguished invitees, donors and all others who helped us in making this consultation a reality. This consultation is being attended by a very broad spectrum of stakeholder interest, encompassing policy makers, eminent administrators from national and international institutions, notable scientists with rich contributions to the area of biodiversity and poverty reduction, representatives of UN organizations, members of the diplomatic corps of some countries, farmers' associations across continents, national and international non-governmental organizations, the media, representing print, visual and electronic fields from some countries, and important donor organizations.

My special thanks go to His Excellency Mr E. Debrah, The Hon Minister of Agriculture for Ghana, the chief guest of this session, for accepting our invitation and delivering the inaugural address. We are happy that in his address Minister Debrah has offered some valuable advice on how to win political support to the cause of biodiversity. The Honourable Ministers from Sri Lanka, Kenya and Tamil Nadu are thanked very especially for making this consultation important with their presence. I am grateful to Prof Chopra, who represents the government of India at this consultation. The vision of this consultation has become a reality with the

support received from the Canadian International Development Agency, the Swiss Agency for Development and Cooperation, the International Fund for Agricultural Development, the Ford Foundation and the Syngenta Foundation for Sustainable Agriculture. We especially thank Dr Rodney Cooke of IFAD, Dr Martin Sommers and Dr Jagannathan of SIDA and Dr Andrew Bennett of Syngenta Foundation for accepting our invitation and for being with us.

I also thank Dr Velayutham, Dr Atta-Krah, and Dr Smith for their introductory remarks, Dr Frison and Dr Cooke for their special and keynote addresses, and Prof Swaminathan for the presidential address, which eminently placed in focus the mission and vision of this consultation.

Participants from nearly 25 countries are here, with a very large representation from developing countries. We also have very eminent resource persons who will be making invited presentations in subsequent sessions and guiding us to the conclusions of this consultation. I thank each one of them for accepting our invitation and wish them a happy stay and fruitful participation. The seed of this consultation was a multi-country based project on under-utilized crops we are carrying out with IPGRI, with the support of IFAD. My friends from IPGRI, Dr Stefano Padulosi, who unfortunately could not be here, and Dr Irmgard Hoeschle-Zeledon, deserve very special thanks for all the help they gave from the day we conceived this consultation. A consultation of this nature, which required planning and preparation over several months, could not have happened without the unreserved help and guidance I received from many of these colleagues. Many of them are actively involved with me in various committees such as the Reception Committee, Transport Committee, Accommodation and Entertainment Committee, Program Management Committee, and others. I will not mention each one by name, as it would take time, but I have great pleasure in extending my sincere thanks to each one of them.

Finally, we received guidance, advice and considerable time from Prof Swaminathan for planning and executing every aspect of this consultation. It gives me a great privilege and pleasure to thank Prof Swaminathan. Similarly, Dr Frison extended personal and institutional support to this consultation. Thank you again, Dr Frison.

Thank you all once again, ladies and gentlemen.

ANNEX II

FULL TEXTS OF PRESENTATIONS

Diversity, nutrition and food security: the case of African leafy vegetables

by R.K. Oniang'o[1], K. Shiundu[2], P. Maundu[3] and T. Johns[4]

Abstract

One third of Sub-Saharan Africa's (SSA) population is malnourished and the ratio continues to increase. At 46%, the proportion of the poor (meaning those living on less than a dollar a day) in this region is the highest in the world. Food production and vegetable and fruit consumption per capita in SSA has been declining in recent decades. This translates into a low consumption of essential micronutrients, the result of which is a high prevalence of micronutrient deficiency related diseases, and reduced capacity to fight the debilitating effects of diseases such as malaria and HIV/AIDS. Women and children are the most vulnerable groups. Recent changes in lifestyle, particularly urbanization, have led to high consumption of fats and refined carbohydrates and relatively less consumption of fruit and vegetables. This has further complicated the nutrition problem in SSA with increased incidences of obesity, diabetes, cardiovascular disease, high blood pressure and cancer.

Ironically, although the continent has to grapple with these nutrition problems, it is endowed with a high diversity of under-utilized micronutrient-dense vegetables and fruits. In spite of the fact that the vegetables are easily accessible and adapted to local conditions, they have been neglected in research and extension and their consumption had been falling over the years. Just as vegetable consumption per capita in SSA has been declining in recent decades, so has the range of vegetables consumed. The range has fallen from hundreds consumed regularly to only a few and often - mainly exotics nowadays. Coupled with reduced consumption is a parallel loss of local knowledge and land races.

Recognizing these shortcomings and the potential of African leafy vegetables (ALV) to improve income and livelihoods and to fight against mineral and vitamin deficiencies, IPGRI, in partnership with a number of institutions in SSA, including ROP and AVRDC, developed a project to enhance the role of these vegetables in improving the nutritional status and livelihoods of vulnerable groups, particularly women and children. This was to be achieved through promotion, increased production and consumption, improved processing, landrace improvement and

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sustainable management of the genetic resources. The project reported significant achievements, among them raising the profile of ALV, providing high quality germplasm to farmers for vegetable production and linking farmers to markets. The project also conducted eco-geographic surveys, collected vegetable germplasm for ex situ conservation and distribution to farmers, collected recipes of priority species, and increased capacity by training farmers and students at M.Sc and Ph.D levels. The project characterized and selected priority species, and carried out research in agronomy, taxonomy, nutritional value and marketing. Besides the research data collected, the implementing groups learned vital lessons which can be shared with other countries.

The project has triggered renewed interest in local vegetable resources in SSA. The activities need to be expanded not only within the countries involved in the project but in other countries also. Research in agronomy, nutrition and germplasm improvement needs to keep pace with the growing interest in local vegetable resources, so as to ensure the availability of quality germplasm and the necessary skills and technology for use by producers and consumers.

This paper attempts to explain the high priority currently being given to ALVs, as they have the potential to contribute significantly to nutritional sufficiency and to earn income for women farmers in Africa. The paper also gives an account of how IPGRI and its partners are promoting the use of these vegetables in SSA, providing - as case studies - the experiences of two local institutions that have been working directly with farmers.

Background

Under-nutrition in Sub-Saharan Africa (SSA)

Sub-Saharan Africa is the region with the highest percentage of undernourished people in the total population. It was estimated that about 34% of the population was undernourished in 1997-99. It is the only developing region in the world where agricultural output has been trailing population growth for most of the last three decades (FAO, 2002). The reasons for Africa's inability to feed itself with sufficient quantities of adequate quality food are numerous and varied. These include conflicts, diseases such as malaria and HIV/AIDS, poor performing economies, poor governance and policies, inadequate technology and technology transfer mechanisms, lack of access to foods that are nutritionally rich in vitamins and minerals, and inability to make full use of the easily-accessible traditional foods.

Under-consumption of vegetables and fruit in SSA

In the past, the emphasis of agricultural research and development had been on increasing production, particularly of energy and protein-giving foods, with little attention being paid to micronutrient-rich crops, mainly fruit and vegetables. Per capita consumption of fruit and vegetables in Sub-Saharan Africa now lags behind that of the other regions, showing an overall decline between 1986 and 1995. While

per capita apparent consumption of vegetables in developing countries rose from 68.7 kg per capita in 1986 to 75.3 kg in 1995 on average (0.92% increase), Sub-Saharan Africa showed a 0.19% decline and remained as low as 29 kg of vegetables on average. The highest consumption was registered in China, where apparent per capita consumption jumped from 86 kg in 1986 to 146 kg in 1995 (a 5.38% growth rate). (Segrè et al., 1998). Although these figures apparently do not take into account traditional vegetables picked in the wild and those obtained from home gardens, they do however point to the possible existence of a serious problem of under-consumption of vegetables and fruit in the region.

It is no wonder, therefore, that micronutrient deficiency (mainly vitamins and minerals - particularly iron, selenium, folate, copper, zinc, iodine and vitamin A) is a serious problem in SSA, affecting about a third of the population and with far-reaching consequences. It is the major cause of anemia and impaired intellectual development in thousands of children; and it also affects the immune systems, provoking birth defects and debilitating the economic prospects of countries (UNICEF, 2004). Children, pregnant and lactating mothers and the elderly are the most vulnerable groups and hence the most affected. Furthermore, under-consumption of micronutrients undermines the region's ability to alleviate the debilitating effects of diseases such as HIV and malaria.

Poverty

Along with the high prevalence of nutrient deficiency is a high level of poverty. About 46% of the population in SSA lives on less than a dollar a day. This proportion is higher than in any other region in the world. Agriculture has failed to jump-start the economy of the region and to provide sufficient food and income for the people. Instead, the environment has suffered through degradation and overuse of resources, with loss of genetic resources further undermining the livelihood security of those living in SSA.

Effect of globalization and urbanization on diets

Globalization and urbanization have drastically affected local diets - increasing the consumption of fat and highly refined, carbohydrate-rich foods and lowering the proportion of fruit and vegetables consumed. These changes and lack of exercise have precipitated a sharp increase in cases of obesity, type II diabetes, cancer, hypertension and heart diseases in SSA and in most developing countries. Urban dwellers, particularly the more affluent, are the most affected. Globally, cardiovascular disease (CVD) is responsible for every third death, and coronary heart disease (CHD) is already the number one killer in the world (WHO Global Strategy on Diet, Physical Activity and Health, 2003).

Neglect and diminishing use

The cultivation and consumption of these relatively common, well-adapted, easy and cheap-to-produce traditional foods has declined in many areas, in favor of the more expensive, high-input exotic foods and crops. East and Southern Africa are

more affected than West Africa. Reasons for this decline include unsupportive or missing agricultural development and research policies as well as negative attitudes towards their use. In the latter case, the vegetables are associated with the poor and backward. Such association affects demand and the marketability of these vegetables, and consequently impacts on production. This vast resource and its potential had therefore gone unnoticed by researchers, development workers and nutritionists in the past. The greater majority of the crops, their seed systems, nutritional value, markets and production skills are, therefore, poorly developed or unknown.

Diminishing diversity

A survey conducted in Kenya in the mid 1990s recorded over 200 edible species used traditionally for leafy vegetables. The picture was no different in the rest of SSA in the early days. In spite of this huge diversity, the variety of leafy vegetables consumed continues to decline, with more people - especially in urban areas - utilizing only a few varieties, dominated by the less nutritious cabbage and kales. Additionally, diversity within species, especially local landraces of cultivated types such as cowpeas, has sharply declined.

The above trend is jeopardizing farmers' ability in SSA to sell their leafy vegetables and earn income, while urban dwellers stand to lose the opportunity to improve their nutrition and health status through these micronutrient-rich foods.

The potential of traditional vegetables in poverty alleviation and improvement of health

Diet diversification, supplementation and fortification

Good nutrition is the basis for good health, not only for the current generation but also for those to come. The need for a broad range of nutrients is seen from the current efforts on bio-fortification in some key crops. Fortification with elements such as iodine through iodized salt has been fairly successful in SSA. With the declining economy in most countries, integrating supplementation and fortification in existing health care delivery systems has been an uphill task in the face of national budget cuts. There is still, therefore, a long way to go before a solution is found for the majority of the most essential elements; moreover, there are many other food components that are very good for the body in different ways but that remain undiscovered. The surest way of addressing the problem of micronutrient deficiency is therefore diversification of diet. In addition, an affordable form of fortification at community level can be undertaken with less purified materials that are rich in a broad spectrum of elements. A number of nutrient-rich foods such as baobab pulp (high in vitamin C) and stinging nettle (*Urtica massaica*) in Kenya are being used increasingly as local fortification material.

African leafy vegetables as sources of micronutrients

Most traditional African leafy vegetables have been shown to contain high levels

of key micronutrients. Most analyses of the raw leaves of amaranths for example give higher values with as much as a factor of ten or more, compared with those of the commonly-used white cabbage. Earlier findings that vitamin A equivalence of B-carotene from plant material is lower than previously estimated (Pepping et al., 1988), however, cast doubts on the bioavailability of B-carotene from the leaves and hence the potential of leafy greens in providing sufficient vitamin A to the body. Notwithstanding these works, there is growing evidence that leafy vegetables consumed in reasonable frequency and quantity can provide the daily body requirements of vitamin A and a number of essential minerals. Haskell, M.J. et al., (2004) for example, working among Bangladeshi men, found that daily consumption of leafy vegetables increased the total vitamin A stores in their body. On the other hand, Mukolozi et al., (2004) found that medium amounts of African leafy vegetables prepared in an oily medium could provide sufficient daily B-carotene intake among children.

Bioavailability of ß-carotene depends on the species and the processing method

Cooked Sample	Amount (µg/g d.m.)	In vitro accessibility	
		(µg/g d.m.)	(%)
Cleome gynandra	857	69	8
+ oil (46%)	744	392	53
Vigna unguiculata	502	43	9
+ oil (34%)	480	184	38
Amaranthus sp.	415	37	9
+ oil (25%)	411	72	18

G. Mulokozi, E. Hedrén & U. Svanberg. *Plant Foods for Human Nutrition*. In press.

High diversity of easily accessible nutritious leafy vegetables

With an estimated 900-1000 species used as vegetables in the continent, Africa has a huge under-exploited potential for meeting some of her micronutrient needs. These vegetables are available and accessible, and knowledge about their use abounds. Moreover, the vegetables are often well adapted to local conditions. Consumption of traditional vegetables can therefore be an effective and affordable means of achieving vitamin and mineral sufficiency.

Source of income

The production of African leafy vegetables is predominantly a woman's job. Women sell excess vegetables to local markets to get money for their household needs.

Rich indigenous knowledge

Besides the wide variety of vegetable resources, Africa has an enormous cultural diversity and hence a rich food culture that is associated with rich local or indigenous

knowledge (IK) of their production and utilization, including the nutritional value of the vegetables. Loss of IK would mean reduced capacity to utilize the entire spectrum of vegetables effectively. Certain communities use certain vegetables for specific nutritional purposes. *Cleome gynandra* for example is widely used by pregnant and breast-feeding mothers, due to its high calcium, provitamin A and iron contents. Some other species have medicinal attributes and besides serving as food, they are also eaten as a remedy for specific ailments.

Intervention by IPGRI and its partners, including ROP and AVRDC

First phase

Having realized the potential role that African leafy vegetables can play in alleviating the micronutrient problem in SSA and the added benefit of conserving crop diversity, IPGRI and its partners initiated the African Leafy Vegetable project in 1996 with partners from several African countries. Participating countries included Botswana, Cameroon, Kenya, Senegal and Zimbabwe. This *first phase* focused on understanding the species used (inventories), the significance of traditional vegetables in community diets, local vegetable production systems and general indigenous knowledge. Besides providing this important baseline information, the phase also identified key constraints in the conservation, production, marketing and consumption of African leafy vegetables. In addition, the participating researchers also identified priority species for further study on genetic resource conservation and use. The technical outputs and development conclusions of the project have been published in a book entitled 'The Biodiversity of Traditional Leafy Vegetables', edited by J.A. Chweya and P.B. Eyzaguirre, International Plant Genetic Resources Institute, 1999.

A meeting convened in Nairobi at the end of the first phase in September 1998, identified some important areas that required follow-up action. These included: Assessment of genetic diversity in priority leafy vegetables; improving seed systems and germplasm management; preparation, processing and marketing; nutrition, agronomic and market research; and participatory selection and plant breeding.

Second phase

The second phase of the African leafy vegetable programme commenced in April 2001 and was set up with these recommendations in mind. The 3-year project endeavored to enhance the role of African leafy vegetables in improving food security, nutritional status and the livelihoods of vulnerable groups, namely women and children, through improved preparation, promotion of consumption, processing, landrace improvement and management of genetic diversity. IPGRI identified some 25 key institutions in ten countries which have been provided with grants to implement the programme.

Some activities of the programme:

- Indigenous knowledge documentation (crop management, seed storage, vegetable processing/ recipes).
- Collection of priority vegetable germplasm in five countries for ex situ conservation, germplasm selection and distribution to farmers.
- Ecogeographic surveys in field, herbaria and genebanks have been used to develop distribution maps.
- Research on agronomic, nutritional, taxonomic, socio-economic aspects.
- Improving seed systems of ALVs
- Enhancing quality of genetic material of priority ALVs through germplasm characterization, evaluation and selection/ breeding.
- Improving handling and processing of ALVs
- Improving marketing systems for ALVs
- Increasing capacity within National Agricultural Research Institutions and universities – through training
- Disseminating information about ALVs to target groups
- Promotion of ALVs

The outcomes of the African Leafy Vegetable Project

The ALV project drew the participation of about two dozen institutions in more than 10 countries of Sub-Saharan Africa, representing NGOs, NARIs, CBOs and GOs.

The project has had a highly significant impact, the key being that of raising the profile of ALVs, leading to increased consumption rates and a change of attitude among urban dwellers.

In Kenya, for example, the rapid expansion and acceptance of these vegetables among the social elite means that ALV production is now a profitable venture and is no longer just a women's crop, meant only to supplement the family diet. Men have taken up the trade, and are also the main consumers. There is no doubt that ALVs are now a much sought-after item on the menus of back-street eating venues as well as in the five-star hotels, and are served even in Parliament. They have moved from being a poor man's vegetable to a much sought-after delicacy by middle and upper income consumers. However, apart from the potential health and nutrition contribution, ALVs contribute to agro-biodiversity in this part of the world. The project works mostly with women and other groups, and includes annual field days, which are well-attended.

The project has managed to improve farmers' livelihoods in the project areas by providing them with high quality seeds and market opportunities in the formal and informal markets. A section of consumers now have better access to the vegetables and this is bound to affect their nutrition and health status positively. Marketing is a major constraint in the use of ALVs and often the missing link. In Kenya this has been solved by training farmers on quality and linking them to the formal market (supermarkets). The appearance of ALVs in supermarkets has given the vegetables status. This success story needs to be scaled-up to other towns and countries. Consumers need more information on nutrition and recipes. The little information there is has proved to be very useful in promotional campaigns and has been in

high demand. Important as urban and peri-urban vegetable production may be, it still poses major challenges regarding hygiene and heavy metal contamination and therefore the need for more studies. The problems of erratic supply of vegetables in the formal sector, seed shortage and post harvest losses, also need to be addressed.

Many other significant outcomes abound, among them, collected germplasm of priority species in five countries, characterization and varietal selection in 5 key species, research in agronomy, taxonomy, nutritional value and marketing, documentation of recipes and capacity building. The latter resulted in 10 students obtaining their M.Sc and one a Ph.D. Besides the research work undertaken, several lessons were learned. Understanding and recording these outputs would be important for the future development of ALVs throughout the continent.

The changing fortunes of ALVs in terms of demand, both in rural and urban areas, has taken place because of spirited efforts to promote the vegetables as a rich source of nutrients - especially micronutrients such as vitamin A, iron, vitamin C and zinc. Their micronutrient levels have been found to be much higher than those of the more commonly-used exotic vegetables, such as kales and cabbage. As a result, the previous attitude that classed ALVs as inferior and fit only for the poor has gradually changed. Now the vegetables are much sought after in most households and many hotels and other eating places. This, in essence, means that their market value has appreciated enormously, and traders are smiling all the way to their banks! Even more noteworthy, men seem to have become the greatest consumers of the vegetables in the recent past; thus, these vegetables now fetch higher premium prices, some being even more expensive than meat or fish.

Contributing to the Millennium Development Goals (MDGs)

The Millennium Development Goals call for reducing the proportion of people living on less than $1 a day to half the 1990 level by 2015 - from 27.9 percent of all people in low and middle income economies to 14.0 percent. The Goals also call for halving the proportion of people who suffer from hunger, between 1990 and 2015. The promotion and increased production of ALVs has far-reaching and clearly discernable linkages in addressing the MDGs, namely child mortality, gender equity, poverty eradication and maternal healthcare, among other goals. Two case studies are provided below to demonstrate how the project contributed to the MDGs.

Case study I: African leafy vegetables in the wider context of Millennium Development Goals (MDGs): ROP's experience in poverty alleviation through women empowerment in Butere-Mumias District, Kenya

The Rural Outreach Programme (ROP) is a non-profit organization based in Kenya. Since 1997, ROP has been working with farmers of Butere Division in rural Western Kenya, to grow African leafy vegetables (ALVs) and to produce seed for marketing, with an overall intention of alleviating poverty and improving nutrition among the

resource-poor farmers of this predominantly sugar-cane growing area of the Western Province. ROP works mostly with women groups. There are over 200 of them, with a membership of about 5 000 people. ROP recognized the marginal position women occupy in this community and therefore initiated the ALV project primarily as a way of addressing food and nutrition security, income generation and women's empowerment - all factors having pronounced, negative effects on the overall well-being of the community.

ALV is probably the only crop today in the western part of Kenya that provides a practical chance for women to earn income. Why? Because, this being a predominantly sugar-cane growing zone, the main cash crop – sugarcane - is dominated by men. The deterioration in the socio-economic status of most households in this area has been attributed to this marginalization of women when it comes to the planning and use of sugarcane proceeds. Studies have found that the introduction of cash crop farming is not necessarily beneficial to food and nutrition security, in some communities. Kennedy and Cogill (1987) found that a shift from maize (food crop) to sugar cane (cash crop farming) resulted in higher incomes but the nutritional status of preschoolers did not change.

ROP started with a modest coverage, serving one sub-location of Butere Division in Western Kenya. The area of focus has since expanded to cover much of Butere-Mumias District. About 5 000 farmers affiliated to ROP now supply vegetables and seeds to other farmers in the rest of the district which has a population of about 540,000 people. The farmers also supply seeds and vegetables to major cities such as Kisumu and Nairobi and this is now a major source of income for them.

Selected trained farmers grow vegetables for seeds. Seed is sold to a local 'seed bank' managed by ROP. On average, the bank receives 40 kg of seed per month from the farmers. In 2001, ROP opened a distribution point in Nairobi, the capital city, where farmers from all over the country (small scale as well as commercial) could access the seeds. Since 2002, ROP farmers have been supplying African leafy vegetable seed to farmers in the peri-urban part of Nairobi and surrounding rural areas. Today, the bulk of the vegetables supplied by farmers to the formal sector in Nairobi is supported by seed material from Butere farmers working with ROP.

The project also attempts to integrate environmental issues by addressing the conservation of ALVs through production and consumption, hence germplasm management of the indigenous vegetables in the form of seeds.

Case study II: Linking peri-urban and rural vegetable farmers to the formal market – the experience of Family Concern Inc.

The rural population in Kenya used a wide range of ALVs but during the last three decades they came to prefer the less nutritious but 'modern' white cabbage as well as an introduced type of kale locally called *Sukuma wiki*. Consequently, local vegetables were not to be found in formal markets such as supermarkets.

A baseline survey showed that most African leafy vegetables were brought from rural and peri-urban areas and sold in filthy streets that turn muddy in the rainy season. This discouraged potential consumers who, in addition, feared that some

vegetables may have been grown with untreated sewer water. Additionally, most young families did not know how to prepare the vegetables and therefore needed recipes.

This not only denied rural and peri-urban farmers of income but rural dwellers who are the most hit by poverty and nutrition-related problems missed an opportunity to improve their health with this large variety of local vegetables.

Partnerships

In 2001, IPGRI along with other local partners started the Phase II campaign to promote local vegetables, capitalizing on their relatively higher nutritional value and their potential to improve health, diversify diets, and provide incomes for rural people. In 2002, IPGRI partnered with a local NGO, Family Concern, which has expertise in marketing, to build the image of the vegetables and to get them to the formal markets.

Family Concern entered into partnership with Uchumi, a leading chain of supermarkets, to provide high-quality leafy vegetables of known sources to consumers. About 70 rural and peri-urban farmers were trained in the best ways of producing high quality ALVs and were also supplied with good seed. Vegetables were supplied to Uchumi under Family Concern's coordination. Meanwhile, IPGRI's partners stepped up their campaign to promote ALVs and dietary diversity in general. Two food fairs were organized in 2003 and four in 2004. Each of these lasted 3 to 7 days. All events were well-covered by the media. Thousands of promotion materials including posters, leaflets, nutrition composition charts, t-shirts, recipe booklets and health brochures were distributed to participants. Two of the events involved a march in the streets. Radio, the most effective local means of communication, was used to pass messages as well.

Outcome

Most people in Nairobi have heard these messages, either through the food fairs and media, or from friends. One message that seems to sink in easily is that the vegetables are highly nutritious and are good for health. Demand rose significantly, due to the guaranteed quality and increased awareness. By early 2003, farmers could meet only 30% of the demand. Eighteen months later, demand had increased tenfold but the supply remained at only 30%. Uchumi started with one store and within the first year it was selling the vegetables in most of its city stores (more than 10) and was considering introducing the vegetables in its branches in other towns. Since early 2004, three other major stores, Ukwala, Tusker Mattresses and Nakumatt, have started selling the vegetables as well. More and more people are getting their supplies from the supermarkets. An indicator of the high demand for ALVs is their price, compared to those of kales and cabbage. On average, one serving for a family of 3 may cost Ksh 30 for ALVs but only Ksh 10 for Kales, an indication that there are more opportunities for farmers to earn income. Another indicator is that many supermarkets run short of the vegetables by early afternoon.

Ripple effect

The entry of such superstores into the arena has raised the profile of ALVs. Not many people associate these vegetables with the poor now, as the rich people also buy them from these stores. The current high profile has contributed to increased demand for the vegetables in the informal sector (open markets and streets). A survey conducted in June 2004 in five informal markets indicated that ALVs had surpassed kales and cabbage as the most consumed vegetables in Nairobi. The same survey showed that more markets and more vendors had started selling ALVs. The seventy original farmers have been joined by many more. Farmers from as far as western Kenya are now supplying vegetables to many city markets. The income going to rural and peri-urban farmers has increased considerably while nutrition and dietary diversity in urban dwellers has been positively affected. What urban dwellers eat is easily picked up by rural dwellers. Increased consumption in urban areas is likely to have a positive effect in some rural areas where the vegetables had been lost.

The campaign to raise the status of ALVs has had far-reaching effects on the ALV markets and on consumption trends in the city. The sale of the vegetables by superstores gave them a higher status. Knowledge of the source gave buyers confidence in their quality. All these have had a positive effect on both the formal and informal markets as the volumes sold there have increased more than ten-fold over the last 18 months. The overall effect has been enhanced incomes and guaranteed markets for ALV farmers, besides improved nutrition among consumers.

Challenges and future direction

Infrastructure

Infrastructure in Africa poses a great challenge in the marketing of leafy vegetables. Most rural growers are poorly served with regard to roads. Road transport tends to be more expensive and so the profit margin is low. It is much cheaper to transport vegetables by railway, but the network is extremely slow and rarely run efficiently. Hence post-harvest loses are often high.

Case study

Women in Butere-Mumias district, particularly in Butere and Khwisero divisions, are among the pioneers of ALV trade in Kenyan urban centres. The main reason why the cultivation and marketing of the vegetables thrived was due to cheap rail transport linking Butere to the major urban areas of Kisumu, Nairobi and Mombasa. With time, and as the business became lucrative, men joined, often as middlemen. Middlemen buy the vegetables in bulk from women farmers at very low prices, and then transport it in passenger trains to Nairobi and other parts of the country.

In the mid 1990s, the rail service to Butere from Kisumu, the nearest city, was suspended for economic reasons. This almost ruined the once-thriving ALV business in the area, which at the time of the suspension stood at over 2 tonnes of train load per day. The main destination was the urban markets of Kisumu and Nairobi. In the

absence of rail transport, most traders resorted to local markets while others opted for buses. But this latter option proved quite expensive and so the majority of traders went out of business.

Almost a decade later, in 2004, the railway services commenced once again and the ALV business was quickly back on track but on a smaller scale because the service was only available two or three times a week. In early 2005, the railway managing agency, Kenya Railways Corporation, banned the use of passenger cabins for transporting any agricultural products, including ALVs, on its Butere-Nairobi train-passenger services. Instead, passengers were supposed to use the luggage cabins. Traders using the luggage cabins suffered heavy losses, due to poor aeration in the cabins leading to rapid deterioration of the vegetables. It is now difficult to use the train and farmers and traders have again turned to the more expensive means – the buses. The traders have formed cooperatives for transporting the vegetables in bulk and also negotiate lower transport costs with local bus companies.

Unfinished business - Policy support

It has been a long struggle to get ALVs to be priority crops, both in terms of research and production, in SSA. For many years, government and private sector efforts have largely benefited the production of a few exotic vegetables – mainly cabbage and spinach (Swiss chard), in the case of Kenya. Very little resources have trickled down to support research and further promotion of production and consumption of the ALVs. The outcome of this discriminative policy has been the continual marginalization of ALVs. The role the vegetables play in enriching diets and enhancing nutrition and health has been neglected.

Indeed, the present increased awareness, production and utilization of ALVs, and the relevant research, are the result of efforts by individuals and institutions with the vision to recognize the unique role of ALVs in food and nutrition security, beyond the need for their conservation, as being part and parcel of the biodiversity that is quickly being depleted due to environmental mismanagement. Organizations such as IPGRI, ROP, the Kenya Agricultural Research Institute (KARI) and others are at the forefront in promoting the use and production of ALVs. The challenge now is to attract more resources, skills and effort, in order to make these vegetables become more a part of everyone's diet. Governments, corporate bodies, major donors, universities and research institutions are called upon to take up the cause of ALVs in word and action. The perennial food shortages in Africa, the HIV/AIDs pandemic that is ravaging the continent, the increasing levels of cancer among all classes of people, diseases caused by micronutrient deficiencies, and others, all call for a change in strategies and focus. Part of these efforts should be directed towards conserving the diminishing plant resources which have been part of the food culture of our ancestors throughout history.

Knowledge documentation and dissemination

The fact that traditional systems, once lost, are hard to recreate, underlines the imperative for timely documentation, compilation and dissemination of eroding

knowledge of biodiversity and its uses. Supporting cultural traditions within extension and public health activities, including recipe books and cooking classes, represent tangible steps in this direction.

On-farm conservation

On-farm conservation of intra-specific diversity and neglected and under-utilized species is a priority for increased agricultural investment in biodiversity management. ALVs are a good example. Adding value to biodiversity by coupling it with the market and with health increases farmers' likelihood of conserving and enhancing diversity.

Awareness and promotion

Perhaps the most immediate priority involves simply increasing awareness of the issues and raising the level of education among health-care personnel, policy specialists and decision-makers along the objectives of WHO's Global Strategy on Diet, Physical Activity and Health. Food and diet are of fundamental personal interest to all humans and thus provide a highly visible vehicle, with local and global impact for linking health and sustainability, and dietary and biocultural diversity. Diversity enriches the quality of life in health, sensory, social, intellectual and moral terms and increases options and resilience for building livelihoods in the short-term and for the future.

Promoting preservation of vegetables

Issues of preservation have arisen in the context of seasonal fluctuations in availability. It has been noted that during dry seasons there is an acute shortage of vegetables. This may call for preservation options, such as solar drying and packaging. It is necessary to promote the consumption of such preserved vegetables among communities where these vegetables are not commonly utilized.

Documenting recipes and developing new ones

Recipe books and cooking classes are practical ways of ensuring wider use. Recipe books for vegetables are rare in SSA. New recipes accepted by contemporary consumers, many of whom are ignorant of traditional cuisines of yester-years, also need to be developed to match modern tastes.

Toxicity

Some vegetable species belong to genera and families known for their poisonous phytochemicals. Genera such as *Erythrococca* (e.g. *E. bongensis* or shirietso), *Crotalaria* (e.g. *C. brevidens* and *C. ochroleuca*), *Symphytum* (e.g. *S. officinale* or comfrey) and *Solanum* (e.g. *S. nigrum*) are all well-known examples. Processing and mixing or alternating with other types of vegetables ensures that the toxicity is brought to levels that are harmless. In spite of all this, it is important to carry out research on toxicity levels, the effect of long-term consumption, the nature of the toxic phytochemicals and the effect of cooking and mixing with other vegetables.

Germplasm Conservation

Some vegetable species or landraces have limited distribution, which makes them vulnerable. A number of cowpea landraces fall into this category. A combination of ex situ and in situ methods would be needed to conserve such landraces appropriately. Other species, such as *Gnetum* spp. are the subject of overexploitation in their Central African wild lands. The leaves of *Gnetum africanum* and *G. buchholzianum* (Family Gnetaceae) are harvested for vegetables in the inland forest areas of Cameroon. The vegetable is also exported to neighbouring countries, such as Nigeria, and abroad in thousands of tonnes per annum. *Gnetum* is not cultivated. All the material is picked from the wild where the species are found as under-storey lianas. This, coupled with an ever-increasing demand for the vegetable, and the gradual shrinking of forests, is threatening the species in its wild habitat and makes it imperative for this vegetable to be harvested further inland.

Gnetum is difficult to grow from seeds and therefore has been difficult to cultivate on-farm. Sustainability can be guaranteed, however, if it is grown by the farmers themselves. Limbe Botanic Garden, in association with other partners, has successfully propagated and subsequently planted out the species, mostly in on-station trial blocks. On-farm trials are now being established and appropriate harvesting methods are being introduced to allow for quick sprouting of vines.

Conclusion

ALVs have great potential for contributing to poverty alleviation and addressing Africa's perennial problem of malnutrition. They are a rich source of micronutrients: they are accessible and knowledge about their preparation is available. Diversity is high and therefore the choice is enormous. However, these advantages may not hold good for long unless governments and research institutions get involved in putting the right policies in place, including increased research, conservation, promotion and extension. There is a reawakening of interest in ALVs, hence the work started by IPGRI and its partners, including ROP and AVRDC, should certainly not be allowed to lose momentum.

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Appendix I

Partners in the IPGRI African Leafy Vegetable Programme:

i. Kenya

- University of Nairobi
- Kenyatta University
- National Museums of Kenya
- Ministry of Agriculture, Kenya
- Kenya Agricultural Research Institute (KARI)
  - Thika
  - Gene Bank of Kenya
  - Kisii Regional Centre
  - Kakamega Regional Centre
- Rural Outreach Program

Figure 1. Partner countries in the IPGRI African Leafy Vegetable Programme

– Family Concern Inc.
– Help Self Help Centre
– Kyanika Adult Women Group
– Kilifi Utamaduni Conservation Group
– Nairobi Friends Club International
– Maseno University
– Moi University

ii. Uganda
– Makerere University (UGANEB)
– Uganda Association of Professional Women in Agriculture and Environment (AUPWAE)

iii. Tanzania
– Tanzania Food And Nutrition Centre (TFNC)
– Tanzania Society of Ethnoscience (TSE), Sokoine University and Arusha Herbarium

iv. Ghana
– NMIMR -Ghana –Nutrition
– PGRC-Ghana- Nutrition

v. Benin
– Institut National des recherches Agricoles du Benin (INRAB)

vi. Togo
– Laboratoire de Botanique et Ecologie végétale, Université de Lomé, Togo

vii. Senegal
– Institut Sénégalais de Recherches Agricoles
– Institut de Technologie Alimentaire (ITA)
– Centre pour le Développement de l'Horticulture (CDH)
– HortiConsult
– Université Cheikh Anta Diop de Dakar

viii. Cameroon
– University of Dschang
– Institute of Agricultural Research for Development (IRAD), Ekona Regional Centre

ix. South Africa
– Talent Consortium
– ARC-Roodeplaat Vegetable and Ornamental Plant Institute

x. Zambia
– National Plant Genetic Resources Center, Zambia

xi. Other partners
– Centre for Indigenous Peoples' Nutrition and Environment (CINE), McGill University
– AVRDC- ARP

Appendix II Priority species for SSA

Kenya

1. *Vigna unguiculata* (Cowpea)
2. *Amaranthus* spp. (Amaranths)
   - *Amaranthus dubius*
   - *Amaranthus hybridus*
   - *Amaranthus lividus/blitum*
   - *Amaranthus cruentus*
3. *Solanum* spp.(African nightshades)
   - *Solanum americanum*
   - *Solanum scabrum*
   - *Solanum villosum*
   - *Solanum eldorettii*
4. *Cleome gynandra* (Spiderplant)
5. *Cucurbita maxima* and *C. moschata* (Pumpkin)
6. *Corchorus* spp.(Jute, crotalaria)
   - *C. olitorius*
   - *C. trilocularis*
   - *C. tridens*
7. *Crotalaria brevidens and C. ochroleuca* (Crotalaria)
8. *Brassica carinata* (Ethiopian kale)
9. *Moringa oleifera* (Moringa)
10. *Urtica massaica* (Stinging nettle)

Senegal

11. *Hibiscus sabdariffa*
12. *Vigna unguiculata*
13. *Moringa oleifera*
14. *Adansonia digitata* (Baobob)
15. *Manihot esculenta*

Cameroon

16. *Gnetum africanum*
17. *Solanum scabrum*
18. *Vernonia amygdalina*

Zambia

19. *Hibiscus* spp.
20. *Cleome gynandra*
21. *Amaranthus* spp.
22. *Corchorus* spp

South Africa

23. *Amaranthus* spp.
24. *Cleome gynandra*

Acknowledgements

This work has been made possible through support from The Netherlands Government, IDRC, JJ Foundation of the UK and CIDA.

Abbreviations and Acronyms

ALV	African leafy vegetables
AVRDC	Asian Vegetable Research and Development Center
CBO	Convention on biological diversity
CHD	Coronary heart disease
CVD	Cardiovascular disease
GO	Government organization
IK	Indigenous knowledge
IPGRI	International Plant Genetic Resources Institute
KARI	Kenya Agricultural Research Institute
MDG	Millennium Development Goals
NARI	National agricultural research institute
NGO	Non-governmental organization
ROP	Rural Outreach Program
SSA	Sub-Saharan Africa
UNICEF	United Nations Childrens' Fund
WHO	World Health Organization

Asian tropical fruits deliver social and economic benefits

by K. Md. Tahir[1] and Y. Ahmad[2]

Abstract

The production and trade of tropical and subtropical fruits have increased substantially during the past decade, from 182.5 million metric tons in 1994 to 261.7 million metric tons in 2003. The bulk or about 65 % of the total production in 2003 originated from the Asian region. The Asian region is also known for its diversity in plants including tropical fruits. Tropical fruits here fall into the categories of traded, less traded, under-utilized and exotic fruits. This paper discusses the social and economic benefits derived from tropical fruits. Socially, emphasis is placed on the nutritional and human health aspects. Tropical fruits, whether traded, less traded or under-utilised, have that edge, in that they contain vitamins, fiber and phytochemicals, which are beneficial for disease prevention. Economically, tropical fruit production enhances income generation for the farmers besides providing employment and creating spin offs in other related services, including transportation, storage facilities and market centers.

This paper also highlights some issues that contribute to the development of the tropical fruit industry. These include research and development, consumer demand, post harvest losses, efficiency of the supply chain, market access, promotional activities and transfer of technology.

Global production of traded tropical and sub-tropical fruits

The production of fresh tropical and subtropical fruits was estimated to have increased by nearly 20 million tons during the past 5 years, to approximately 261 million tons in 2003. The bulk of the production was from Asian countries, contributing to some 65.3% of the total world production. This was followed by Latin America 13.7%, Africa 9.2% Europe 3.7% and Oceania 0.5% (FAOSTAT).

Of the total production of 261 million tons in 2003, the main fruit types produced were watermelon (33%), banana (26%), mango (10%), melon and cantaloupe (8%), pineapple (6%), lemons and lime (4%), papaya (2%), other citrus (2%), grapefruit, (2%) avocados and persimmon (1% each) and other fruits (5%).

The total export market for tropical fruits in 2003 was valued at USD 8.983 billion. Even though Asia appeared to be the main producer, the export market was

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dominated by Latin America and the Caribbean which exported more than 53% of total tropical fruit exports, valued at about USD 3.7 billion in 2003. Banana was the main fruit exported, dominating 50% of the total export market, valued at USD 4,363 million, followed by lemons/limes and cantaloupes, both at 8%, pineapple 7%, other citrus fruit 6%, grapefruit 5%, avocados 5%, watermelon 4%, mango 4%, other fruits 2%, papaya 1% and persimmon, also 1% of the total export value. The export value of processed tropical fruits was close to USD 2.0 billion in the same year (FAOSTAT).

In India alone, production of tropical fruits increased from 28,528,079 t in 1994 to 34,950.000 t in 2003 with bananas and mangoes dominating the total production at 47.07% and 32.62% respectively. The other tropical fruits contributed to less than 4% of the total production. These were lemons/lime (3.92%), pineapple (3.15%), cantaloupes and other melons (1.85%), watermelons (0.73%), other citrus fruits (0.66%) and other tropical fruits (8.01%). However, 84.76% of the total export of fresh tropical fruits was dominated by mango. Also in 2003, with regard to processed fruit products, the main export products were pineapple juice single strength and grapefruit juice concentrate at 51.05% and 45.74%, respectively (FAOSTAT).

Statistics indicate that the main tropical fruit types on the global market are confined to only a handful compared to the abundance of fruit types that can be developed.

Most tropical fruits on the market are commercially produced and the demand is determined by the consumptive pattern of the consumers. Market demand for such fruits has also resulted in the improvement of current commercial varieties. This has been done through extensive research and development in producing high-yielding varieties, with modern farming techniques in the areas of plant growth manipulation, mechanization and the like.

It is estimated that less than 4% of the total world production of tropical and subtropical fruits are traded, while the rest are consumed domestically.

Other less-traded fruit types that have been developed recently, and some commercially grown for the export market, include carambola, guava, lychee (litchi), mangosteen, passion fruit, durian and rambutan.

There is also the other category that needs to be developed, the 'other potential varieties', which comprise lesser-known, exotic or traditional varieties. Usually, the traditional varieties continue to be maintained, to cater for domestic or indigenous needs.

Trade liberalization and tropical fruits

It had been reported that with the present agricultural trade liberalization policies, trade in tropical fruits increased from USD 30.1 billion in 1991 to USD 44.6 billion in 2000, registering a growth rate of 4.4% per annum during that period. This was higher than the 2.3% recorded for all fruits. It had also been shown that average trade of tropical fruits had increased 23% between pre-WTO (1991 – 1996) and post-WTO (1997 – 2000) from USD 35.6 billion to USD 42.5 billion. Exports increased 24% between the same periods. It was interesting to note that there was

also an increase of more than 30% in the importation of tropical fruits amongst these developing countries between the pre- and post-WTO period. (Tengku Mohd Ariff Ahmad. 2000)

Generally, the liberalization in agricultural trade has been beneficial and favorable to the trade of tropical fruits, especially for developing countries.

Biodiversity and tropical fruits

Of a total of about 3000 tropical fruit species, 500 species are found in Asia alone (Singh, 1993). However, only a few have been developed and the rest still remain undeveloped and under-utilized. The most important fruit crop diversity comprised 30 families and 59 genera. It had also been reported in 1993, that there were about 120 major and 275 minor species of tropical fruits and nuts in South East Asia (Verheij and Coronel, 1993). There were also some 200 species that had economic potential. Some important examples of diversity in tropical fruits are to be found in rambutan, mango, citrus, papaya, langsat, salak (salacca), durian, mangosteen, lychee (litchi), longan chempedak, jackfruit and banana.

An example in tropical fruit diversity can be cited for mango, which is known to have 57 species with 26 to 30 species that can bear fruit. There is also an astonishing figure of 1000 cultivated varieties in India alone. Moreover, there were 30 commercially-traded varieties grown on a large scale in India for the different consumer preferences of varieties in different regions. (Ghosh, 1997).

The over commercialization of some of the tropical fruit varieties has actually hampered efforts to seek out the development of under-utilized varieties that have economic potential or nutritional benefits. Even though the concern to examine this issue has been on the agenda of many countries, there have not been many inroads for several reasons, including low yield, poor appearance and the unique acquired taste of the under-utilized varieties. The choice of developing only a few varieties is also due to the myopic policy of some governments to focus only on 'economically viable' short-listed tropical fruit varieties.

Countries that are in the tropical belt are endowed with rich plant biodiversity. While some of the under-utilized plant species, which include some fruit species, have already been developed and consumed, based on traditional and cultural practices, many more still remain unidentified. Some of the durian species fall under this category. Other less-known species are Galo nut (*Anacolosa frutescens*), distributed in Indo-China, Myanmar, Thailand, Malaysia, Indonesia and the Philippines, Malingo (*Gnetum gnemon*) found mainly in Indonesia and some varieties from the rose apple (*Syzyguim malaccense*). (Arora, 1997)

Rampant destruction of forested areas as well as monocropping on arable land does little to advance the development of lesser-known indigenous fruit varieties. It is thus timely to embark upon the development of under-utilised tropical fruits for the purpose of providing a balanced and diverse diet to consumers in developed and developing countries alike. Besides this, the species can be cultivated and genetically maintained.

The social benefits of tropical fruits

The most important social benefits of tropical fruits is their nutritional contribution to the health and well-being of communities. This includes the improvement of nutrition security for vulnerable groups, especially women and children. Besides the nutritional benefit, the cultivation of tropical fruits, especially the less-traded and under-utilized species, should contribute to the sustenance of the environment and the agricultural production system. In addition to this, any indigenous knowledge on the traditional uses of these fruits can also be optimized.

For the past 40 years, large-scale commercial production of staples such as wheat, rice, or maize has, to a certain extent mitigated the problem of hunger in the world. However, with the growing world population, there is still much to be done, as stipulated by the Millennium Development Goals, to halve the number of those suffering from hunger by 2015. While the consumption of grains has alleviated the carbohydrate and protein problem, it has been pointed out that there is the predicament of 'hidden hunger', a nutritional condition described as lack of micronutrients, vitamins, minerals and other diet components that are so essential for a balanced and harmonious body and mind. (Frison, et al., 2004)

A commonly quoted case is the lack of Vitamin A or VAD, which is so prevalent today, affecting the health of children and mothers. It had been reported that VAD weakens the immune system of 40% of children in the developing world. It also causes blindness in children and increases the risk of severe illness and death (WHO, 2002). Studies by Sommer & West, 1996; Shanker et al., 1999; and West, 2000, indicated that VAD contributed to higher rates of anemia from childhood infections such as measles, respiratory and diarrheal diseases, and also malaria.

The consumption of tropical fruits together with vegetables has always been recommended to alleviate this problem of 'unbalanced diet'. Tropical fruits, especially those in the traded and less traded categories, have always been promoted as containing valuable vitamins, including vitamin A, antioxidants and fiber.

Referring to the biodiversity of tropical fruits, there is a vast treasure of potential nutritional values of the less-traded, under-utilized and exotic tropical fruits that needs to be elucidated and exploited.

The development of less-traded and under-utilized tropical fruits certainly needs much more attention as a more varied range of these would complement and contribute to what has been termed as a 'diverse diet', which is so important for nutritional well-being.

Nutrition, diet and tropical fruits

Nutritionists have always associated fruit consumption with good human health. The contents of fruits that contribute to this effect include dietary fiber, unsaturated fatty acids, vitamins and antioxidants. It had been reported that low fruit intake was estimated to cause about 31% of heart disease and 11% of strokes worldwide (World Health Report, 2002). Furthermore, increased fruit consumption could

help in decreasing incidences of cancer by 5-12% **(**WHO-International Agency for Research on Cancer [IARC], 2003). Dr Wael K Al-Delaimy, from the IARC had stated that "Of all dietary factors in cancer prevention, the most abundant evidence is for the protective effect of fruit and vegetable consumption".

It is also well documented that co-existing and acting synergistically with these vitamins are a class of substances called phytochemicals. Generally, these chemicals have an antibacterial effect and may protect against certain cancers, as antioxidants, and interfere with the absorption of cholesterol, thereby protecting against cardiovascular diseases. (Samir, 2001). There has been extensive research carried out on the phytochemicals in tropical fruit species, their properties, the myriad of actions on specific health conditions and traditional remedies. The treatment of specific health conditions in countries with a variety of tropical fruits shows the various dietary benefits.

An example is in the sour sop or *Anona muricata,* which besides containing carbohydrates, protein, fat, fiber, calcium, phosphorus, niacin and ascorbic acid, also contains 50 phytochemicals, including acetaldehyde, amyl-caproate, campestero, cellobiose, citric acid, myristic acid and others. The medicinal properties of this fruit have been described as antibacterial, anti-cancerous, anti-parasitic, anti-tumorous, antispasmodic, astringent, cytotoxic, febrifuge, vascodilator and sedative to name a few. Besides this, its use and benefits seem to be quite universal in the various countries. For example, in the Bahamas, the fruit or plant parts are used for chill, fever, flu, nervousness, palpitation, rash, skin diseases and as a sedative. In Brazil, it is used as an analgesic, and to cure fever, neuralgia, parasites and rheumatism, while in Malaysia it is used for coughs, boils, dermatosis and rheumatism. There are also reports that regular intake of the sour sop fruit juice can reduce the problem of gout (www.raintree.com).

In another study with guava and papaya, it had been reported that both fruit types reduced the level of total cholesterol in the subjects tested by 18.8 % and 23.3 %, respectively compared to the baseline level. Guava also reduced the level of Low Density Lipoprotein (LDL) to 19.4 %, while with papaya the level was reduced to 23.3 %. This study suggested that tropical fruits such as guava and papaya had the potential to reduce lipid levels in humans (Rokiah, et al., 2003).

The consumption of tropical fruits and its advantages in providing nutrients, prevention of diseases and human well-being is a known fact. Presently, the use of under-utilised or exotic fruit varieties for this purpose is mainly based on traditional cures. More research and development should be embarked on to elucidate the potential of some of these fruit varieties in the different countries.

Economic benefits of tropical fruits

The economic benefits derived from the production of tropical fruits are mainly related to increasing income, employment generation and reduction of poverty.

Various studies have been undertaken to confirm that farmers who grow and produce horticultural crops are better off than their counterparts who grow grains

and cereals. Generally, in the developing countries of Asia and Africa, farmers engaged in horticultural crops earn more than those engaged in cereal production. (Abedullah, et al., 2002; Ali and Hau, 2004; Cock and Voss, 2004; Francisca, 2004; Hau, et al., 2002.) In India, Subramanian, et al. (2000) reported that fruit and vegetable production generated five to eight times more profit compared to cereal crops. In another study in Kenya, it was reported that fruit, vegetables and flowers generated income that was six to twenty times more profitable than maize (Gabre-Madhim and Hagglade, 2003; Minot and Ngigi, 2004). Thus, the growing of tropical fruit crops, either monocropped, mixed or planted in combination with vegetables, seems to be economically better than planting cereals alone.

The spin offs in the tropical fruit industry in the form of services such as transportation, packaging, cold room facilities and market centers, also contribute to income generation and to the overall economic growth of an area. Besides this, the farmers can also expand their economic activities by going into value added products, such as processing or integrated agro-tourism as an added attraction.

The development of tropical fruits biodiversity will also enhance their production, consumption and utilization.

Issues related to the development of tropical fruits

The contribution from developing a vibrant tropical fruit industry will obviously have an impact on the social and economic status, especially of a developing country. Fruit trees are grown not only for economic reasons but also to provide nutritional benefits for the smallholders and the general population. Cognizant of the fact that a viable tropical fruit production program can help raise the income and thus the economic status of the growers, some issues that are predominant in the developing countries need to be resolved.

These issues may differ according to a country's economic and agricultural policies, and production systems. Among them are:

- Research and Development
- Consumer demand and market drive
- Post harvest losses
- Value added products
- Efficiency in the supply chain: capacity building, infrastructural development
- Market access – Domestic and Export,
- Transfer of Technology – Extension and training

Research and development on tropical fruits

Research and development is the most important component in developing a highly successful tropical fruit industry. The suggested areas of R & D include investigation into under-utilized species with respect to production, processing, consumption, and conservation. The study of metabolomics in under-utilized tropical fruits can also help identify species that can be exploited, based on their nutrient content. It

can include an investigation into deterioration characteristics of each fruit type or variety to ensure that the fruit is consumed at the best maturity time, taking into account its 'most available' nutritive content.

For a research and development program in tropical fruits to be successful, each country needs to focus and prioritize its field of research.

Consumer demand and market drive

Market driven forces determine the production of tropical fruits for the domestic or export market. The underlying factor is still consumer demand. Consumer demand is varied and related to the different cultures and traditions. Some of the consumer demands are centered on the physical appearance such as a specific fruit size and color, flavor, quality (food safety) and its presumptive value as natural and healthy (organics) products. Consumers also look for variety and choice, convenience (minimally processed) and, until recently, new fruit products such as enzymes, intermediate moisture tropical snacks (IMTS) and vacuum dried products.

Thus, before embarking on any tropical fruit production program, it is imperative to gauge the behavior and idiosyncrasies of the customers. This is one reason why the development of under-utilised tropical fruits is still not up to the desired level. Promotion focused on the 'common or frequently traded' fruits at the expense of the under-utilized fruits will perpetuate the ongoing unpopularity or lack of consumption of under-utilized fruits. In the light of the role of supermarkets and the hypermarket, the promotion of under-utilized fruits needs to undergo 'customized market strategies' i.e., specific, molded, and flexibly responsive, in compliance with the requirements of supermarket chains. (Reardon, 2005).

Post harvest losses

One problem that is evident in a tropical or subtropical environment is the quality deterioration of fruits immediately after harvesting. Depending on the fruit type it is estimated that 10 – 60 % of harvested fruits are lost due to poor post-harvest handling. This includes the time of harvesting, field transportation, storage and packing. For example the durian is only good for 1 or 2 days after it ripens and drops naturally. This poses a serious marketing problem due to the short time available to sell it. Some of the efforts to mitigate losses include early harvesting, freezing the fruit and also processing the pulp into durian cakes and other products.

Post-harvest losses differ for each fruit type at the various stages of the handling process. With the consumer demand based on quality, post-harvest losses are now seriously pursued with efforts to minimize this problem. This calls for more R&D in the application of technology to evaluate and enhance quality, especially in the handling, processing and storage.

One example of simple post-harvest technology is the construction of low-cost storage chambers, as developed at the Indian Agricultural Research Institute, New

Delhi, which work on the principle of evaporative cooling. It has been claimed to keep temperatures 10 to 15 % cooler than the outside temperature and maintain about 90% humidity, which is effective in extending the storage life of tropical fruits (Mitra, 2003).

Value added products

An integral activity in any fruit development program is the processing component. This can overcome the problem of glut for seasonal fruits and the lack of storage facilities. This issue is also related to R & D and has to be aligned to cater for customer demand for safe, clean and wholesome products. R & D also needs to be more focused, even working to improve products that are already on the shelves. The other important issue related to this is the branding and promotional component of the product.

Efficiency in the supply chain

This means the degree of efficiency in the management of a supply chain where the consumer dictates the quality of marketable products. Efficiency here refers to the infrastructural development that is in place to enhance all activities or operations involved in the supply chain. In many developing countries this may be a constraint. Thus, it is imperative for Governments to provide basic infrastructure, such as roads, collection centers and storage facilities to facilitate efficiency in the supply chain.

The other area relates to capacity building, where stakeholders along the supply-chain - especially extension agents and farmers - are trained and made to understand that the different stages of the supply-chain will eventually determine the marketability of the products.

Market access

Most of the tropical fruits are marketed domestically. However, the export market is becoming increasingly important. Statistics indicate that exports had increased by 24% between 1991/96 to 1997/2000 (Tengku Mohd. Ariff., 2003). Export markets are also crucial for economic development, especially in developing countries. In an era of globalization and trade liberalization, compliance with market access requirements such as GAP, Eurepgap, SPS, food safety and traceability, become key features. Developing countries would have to grapple with these issues, in the long run, to ensure better access to markets in the developed countries.

To overcome this, governments in developing countries first need to educate and train farmers to produce quality and safe fresh or processed fruit products that conform to the standards stipulated. It is also important for them to appoint independent bodies to accredit and certify the farms that are producing quality fruits.

Transfer of technology

In modernizing the agricultural sector, transfer of technology or knowledge dissemination is now a prominent focus of many developing countries. To further develop the tropical fruit industry, transfer of technology from research institutions and academic institutions is required to keep the growers, producers or processors aware and to adopt the latest technologies. More often than not, farmers are not exposed to new technologies that can increase their yields or income. The extension system or information dissemination system must be in place, as a pre-requisite. However, there seems to be a deterioration in such systems. With the world now totally immersed in the internet age, it is perhaps timely to include Information and Communication Technology as a tool for information dissemination, provided that the digital divide between urban and rural can be narrowed.

Conclusion

The production and trade of tropical fruits have increased substantially in the past decade. With the bulk of the production coming from the Asian region, it has continued to benefit developing countries, both socially and economically. The social benefits are mainly in the nutritional and human health aspects. Tropical fruits, whether traded, less-traded or under-utilized, do have that edge, in that they contain vitamins, fiber and phytochemicals, which are beneficial for disease prevention. Economically, tropical fruits enhance income generation besides providing employment, and create spin-offs in other related services.

The tropical fruit industry can be further strengthened and fine-tuned through programs that can resolve issues relating to research and development, consumer demand, post harvest losses, efficiency of the supply chain, market access, promotional activities and transfer of technology.

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Abbreviations and Acronyms

CBD	Convention on Agricultural Biodiversity
Eurep	Euro Retailer Produce
FAOSTAT	FAO Statistics
GAP	Good agriculture practices
IARC	International Agency for Research on Cancer
IMTS	Intermediate moisture tropical snacks
LDL	Low Density Lipoprotein
R&D	Research and Development
SPS	Phyto and Phytosanitary
VAD	Vitamin A deficiency
WHO	World Health Organization
WTO	World Trade Organization

Andean grains and tubers: ancient crops for better livelihoods today

by J.G. Blajos Kraljevic[1]

Abstract

The Andes represents one of the most important mountain systems in the World. It is home to a huge number of agroecological niches, due mainly to the great differences in climate and humidity. This region is the center of origin of a great diversity of vegetable and animal species, as well as of cultures.

An important group of Andean crops is the so-called Andean grains, which are found throughout the Andes from Colombia down to Chile and Argentina, at altitudes ranging between 2500 and 4200 meters above sea level. The best representatives of this group are quinoa (*Chenopodium quinoa*), cañihua (*Chenopodium pallidicaule*) and amaranth (*Amaranthus caudatus*).

Andean grains are known in particular for their exceptional nutrition value. They are a natural source of vegetal proteins and an important source of essential amino acids, especially lysine and threonine.

Andean grains also show promising nutraceutical and pharmaceutical uses. Cañihua and amaranth, both possessing a high iron content, are used locally to treat people suffering from anemia (especially pregnant women and nursing mothers), tiredness and altitude sickness.

On the agronomic front, Andean grains are often tolerant to insect pests, diseases, drought, frost and salinity and so perform very well in marginal lands. In particular, quinoa and cañihuia are reported to be very tolerant to salinity, frost and drought.

Processing is an issue where Andean grains have proven to have great potential. Traditionally, they have been used in a wide range of food products aimed at local consumption. Because of their exceptional nutritional value, these products have been gaining interest recently in developed countries as well, mainly in the organic markets. Novel products, such as pasta, breakfast cereals and power bars are also being developed.

Recent research indicates that amaranth flowers contain considerable amounts of beta-cynanins, non-toxic red colorants, which could be used in food and in the cosmetic industry.

Promoting the consumption of Andean grains is an essential step in order to increase their use and to create new food habits among the population, especially children and pregnant women.

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Eight thousand years ago, the Andean cultures domesticated the potato. Although potatoes are diffused worldwide, there are other tubers and potatoes of varying species, known as 'native potatoes', which are not well-known, but give food support to millions of farmers in the Andean region.

In rural zones of countries such as Peru, Bolivia and Ecuador, the potato is the main source of energy and vitamins. It is estimated that average consumption could reach 90 kilograms per person/per year. The various 'native potato' species with their different colours and shapes and diverse flavors, are included in this estimate. In many zones, the native potatoes also have a cultural role to play. There are 1300 accessions (varieties) of the native potato, which are registered only in the National Tubers Bank of Bolivia. Some of these are bitter and resistant to frost (they are produced at altitudes above 3900 msl) and thanks to the ancestral technology, dehydrated products that have lost their bitter flavor, such as chuño and tunta, can be kept for many years.

Besides the potato, other Andean tubers, such as oca (*Oxalis tuberosa*), ulluco (*Ullucus tuberosus*) and isaño (*Tropaelum tuberosum*), are also consumed. They are grown to a very limited extent, due to soil and humidity demands and, in general, have a long cycle of 6 months or more. Their nutritional quality is similar to that of the potato.

The consumption of native potatoes and other tubers in urban zones is very low, meaning that these species have reduced markets and are quickly replaced by meals such as noodles and rice. For many farming zones, native potatoes and Andean tubers are practically the only production option. Despite this, threats of losing these crops are high, due to a reduced market.

In view of this situation, non-traditional alternatives must be considered for massive consumption of these species and in this way the agro-industry can be seen as an attractive option. Pilot experiences with frozen, pre-boiled native potato export and native chip potatoes show a potential for opening up new markets. Nevertheless, the task is a complex one and must be worked out in a very coordinated manner with the agro-industry.

The other potential contribution from the native species is their genetic wealth, thus contributing to the generation of varieties with greater and better productive characteristics. It is fundamental that they be characterized molecularly.

It is impossible to think of making good use of the native species without an improvement program adapting the nutritional potential to the changeable demands of production and market systems. Unfortunately, in many countries of the Andean region, research funds have been reduced and, in others, research and improvement programs have actually been closed.

Grains and Andean tubers provide us with a series of opportunities to significantly improve the food quality and quantity of the rural and urban population. They can also` contribute to improving the income levels of farming families. It depends on us to make the best use of these opportunities.

Introduction

The Andean eco-region extends over two million square kilometres, from the South of Venezuela to the North of Argentine and Chile, including Colombia, Ecuador, Peru

and Bolivia. The eco-region includes one of the most fragile and least understood environments of the planet. It harbours more than 60 million people, half of them linked to farming activities and living at levels of extreme poverty. During the last thirty-five years, millions of Andean populations have abandoned their fields and migrated to coastal or tropical cities. This has led to the destruction of natural resources through soil erosion, loss of genetic resources, deforestation, over-pasture, and soil and irrigation water contamination due to waste caused by mining activities.

The higher rates of severe and chronic malnutrition in children less than five years old are common in this region. In general, the population is suffering from lack of iodine and Vitamin A. Women are usually more vulnerable to nutritional problems due to their economic and lower social conditions. When men migrate, women are obliged to carry a great deal of responsibilities. This additional effort is not compensated by a better diet.

The particular agro-ecologic conditions of the Andes, the effects produced by climate change and the socio-economic situation, such as the greater concentration of poverty registered in the mountainous Andean region. In some countries, such as Bolivia, poverty in rural Andean areas encompasses 95% of households.

On the other hand, inadequate post-harvest management (from 30 to 40% is lost, depending on food), does not allow the producer to organize the sale of his products throughout the year and take advantage of fluctuating market prices.

Nevertheless, the Andean region of South America - one of the most important mountain systems in the world - has great genetic diversity because it is one of the centres of origin of agriculture and livestock diversity and, consequently, one of the most important world centres of plant and animal genetic resources. The biological diversity of the region is reflected in its cultural and human diversity as well.

The purpose of this document is to analyze how two of the most important groups of Andean crops, Andean grains and tubers, can contribute to improving food conditions and reducing poverty.

Andean Grains

One important group of Andean crops is the so-called Andean grains. These grains are found throughout the Andes from Colombia down to Chile and Argentina at altitudes ranging between 2500 and 4200 meters above sea level. The most representative of this group are quinoa (*Chenopodium quinoa*), cañihua (*Chenopodium pallidicaule*) and amaranth (*Amaranthus caudatus*).

Andean grains are generally praised for their exceptional nutrition value. They are a natural source of vegetal proteins and an important source of essential amino acids, in particular lysine and threonine. Their unique amino acid balance is often compared to that of dairy products.

Quinoa, cañihua and amaranth are three small grains with a well-developed embryo (25% from the total quinoa grain), in which an important quantity of proteins is concentrated. The protein and fat content of these grains is higher than that of cereals (Table 1).

Table 1. Composition of some Andean grains in comparison to wheat (g/100g)

	Quinoa[a]	*Cañihua*[a]	*Amaranth*	Wheat
Proteins	11.7	14.0	12.9	8.6
Grease (Fat)	6.3	4.3	7.2	1.5
Carbohydrates	68.0	64.0	65.1	73.7
Fiber	5.2	9.8	6.7	3.0
Ashes	2.8	5.4	2.5	1.7
Moisture	11.2	12.2	12.3	14.5

[a] Average values of varieties taken from a Peruvian food composite table (Ministry of Health / National Health Institute / National Centre of Food and Nutrition, 1996)

The Andean grain proteins differ from cereal proteins, not only in quantity but also in quality. When reviewing the amino acid contents from the quinoa, cañihua and amaranth proteins, and considering only the amino acids which are more frequently limiting in mixed diets: lysine, sulfur-containing amino acids (Methionine + cystine), threonine and tryptophan, it is possible to observe that, excepting tryptophan, their amino acid content in general is superior to that of wheat proteins (Table 2).

Table 2. Content of lysine, methionine, threonine and tryptophan in Andean grains and in wheat (mg of amino acid/g of protein)

Amino acids	*Quinoa*[a]	*Cañihua*[a]	*Amaranth*[a]	Wheat[b]
Lysine	68	59	67	29
Methionine	21	16	23	15
Threonine	45	47	51	29
Tryptophan	13	09	11	11

[a] average values of varieties taken from a Peruvian food composite table (Ministry of Health/ National Health Institute/ National Centre of Food and Nutrition, 1996).
[b] FAO, 1972

Unlike the cereals, lysine is not amino acid limiting in Andean grains. Quinoa presents the phenylalanine + thyroxine as being the only amino acid constraint. Cañihua has four amino acid constraints: the first one is phenylalanine + thyroxine, the second one is methionine + cystine, the third one thriptophan and the last one leucine. The amaranth has as a first constraint, the phenylalanine + thyroxine and the leucine as the second one.

The constraints diminish the use of these food proteins. For example, from the total of cañihua and amaranth proteins, only 55% is used and absorbed, a percentage

established by the first amino acid constraints (phenylalanine + thyroxine). Quinoa also presents the phenylalanine + thyroxine as a first constraint. The protein absorption reaches 63% (Annex 1).

To improve the quality of Andean grain proteins, they can be mixed with foods of vegetable origin whose constraints are different - for example, legumes such as the *Lupinus mutabilis* or the *Lupinus albus*. If, besides this mixture, small quantities of protein of animal origin, like egg or milk, are added, the protein qualities of a mixed diet will improve enormously.

The other correction factor of biological protein quality is the digestibility or proportion of consumed and absorbed nitrogen. The digestibility of egg, milk and meat proteins is close to 100%. Because of its high fiber content, the cereals, legumes and Andean grains are less digestible. It is estimated that the digestibility of Andean grains is approximately 80%.

Greater attention is always given not only to the crude fiber contents but also to soluble fibers or total dietary fiber, because of the beneficial effects on digestion, mainly through the water absorption capacity, and absorption of organic compounds and gel formation. The fiber contents of Andean grains are presented in Table 3.

Table 3. Content of insoluble and soluble fiber and total dietary fiber (TDF) in Andean grains

Product	Insoluble fiber* (g/100g)	Soluble fiber (g/100g)	TDF (g/100g)
Amaranth	5.76	3.19	8.95
Cañihua	12.92	3.49	16.41
Quinoa	5.31	2.49	7.80

Source: Repo Carrasco, 1992.

The cañihua has a high content of dietary fiber, especially insoluble fiber. The amaranth and quinoa contain more or less the same proportion of dietary fiber with differences in fractions.

Regarding the minerals, the content of phosphorus, calcium and amaranth magnesium is superior to that of quinoa but the latter exceeds amaranth in potassium - an element that is generally related to the plant's better resistance to low temperatures (Table 4).

Table 4. Contents of minerals in Andean grains

Minerals	Amaranth*	Quinoa**
Phosphorus	570	387
Potassium	532	697
Calcium	217	127
Magnesium	319	270
Sodium	22	11,5
Iron	21	12
Copper	0,86	3,7
Manganese	2,9	7,5
Zinc	3,4	4,8

* mg/g M.S. (Bressani, 1990)
** average of different authors and data base (Latinreco, 1990)

Potential of Andean Grains

Andean grains show promising nutraceutical and pharmaceutical uses. Cañihua and amaranth, both possessing high iron content, are used locally to treat persons suffering from anemia (especially pregnant women and nursing mothers), tiredness and altitude sickness. Quinoa is ideal for people who cannot tolerate gluten in their food (known as Celiatic disease). It is gluten free, and its derivatives, such as quinoa flour and flakes, are ideal for preparing dishes for Celiatics.

From the agronomic standpoint, Andean grains are often tolerant to insect pests, diseases, drought, frost and salinity, and therefore perform very well in marginal lands. Quinoa and cañihua in particular are reported to be very tolerant to salinity, frost and drought.

Processing is an issue where Andean grains have proven to have great potential. Traditionally, they have been used in a wide range of food products intended for local consumption. Because of their exceptional nutritional value, these products are recently gaining interest in developed countries as well, mainly in the organic markets. Novel products are being developed, such as pasta, breakfast cereals and power bars. This could result in an increasing demand for the primary products, which could form an important source of additional income for local farmers, especially if they are involved in the first steps of processing.

Recent research indicates that amaranth flowers contain considerable amounts of beta-cynanins, non-toxic red colorants, which could be used in food and in the cosmetic industry.

Promoting the consumption of Andean grains is the essential step towards increasing their use and creating food habits within the population, especially for children and pregnant women. Agro-industrial usage could be one of the most successful ways of promoting Andean grains' contribution to food security and poverty alleviation.

In general, traditional products meet with difficulty in adapting to the uniformity and presentation demands that modern markets impose, representing a limiting factor in expanding their use to a population with consumption habits.

The agro-industry plays a fundamental role in extending and diversifying the use of traditional products. The elaboration of flour and flakes from Andean grains has opened up a range of possibilities for elaborating products of modern presentation while maintaining the quality and taste of traditional products. Thus, producers find new ways of commercializing their products, but they also face new challenges because they have to meet demands that are very different from those related to the markets of traditional products.

Andean Tubers

Eight thousand years ago, the Andean culture domesticated the potato. Although potatoes are disseminated worldwide, there are other tubers and potatoes of different species called native potatoes which are not well-known, but contribute to the food of millions of families in the Andean region.

In the rural areas of countries like Peru, Bolivia and Ecuador, the potato is the main source of energy and vitamins. It is estimated that the average consumption could reach 90 kilograms per person per year. The various 'native potato' species with different colours, shapes and diverse flavors are included in this percentage. In many zones, the native potatoes have a cultural role to play, as well as the usual nutritional role. There are 1300 accessions (varieties) of the native potato, which are registered only in the National Tubers Bank of Bolivia. Some of these are bitter and resistant to frost (they are produced at altitudes above 3900 msl) and thanks to the ancestral technology, dehydrated products that have lost their bitter flavour, such as chuño and tunta, can be kept for many years.

Besides the potato, other Andean tubers, such as oca (*Oxalis tuberosa*), ulluco (*Ullucus tuberosus*) and isaño (*Tropaelum tuberosum*) are also consumed. They are grown to a very limited extent, due to soil and humidity demands and in general, they have a long cycle of 6 months or more. Their nutritional quality is compared to that of the potato.

The oca, isaño (maswa) and ulluco (papalisa) are good sources of energy, due to their carbohydrate content. Like all tubers, they are low in protein and fat (Table 5).

Table 5. Chemical composition of Andean tubers (g/100g)

	Oca	Isaño	Ulluco
Energy (kcal)	61.0	50.0	62.0
Protein	1.0	1.5	1.1
Grease (Fat)	0.6	0.7	0.1
Carbohydrates	13.3	9.8	14.3
Fiber	1.0	0.9	0.8
Ashes	1.0	0.6	0.8
Moisture	84.1	87.4	83.7

Ministry of Health/INS/National Center of Food and Nutrition, 1996

Tubers (oca, ulluco and isaño) do not represent a good source of protein, neither in quantity nor in quality. For example, oca is lacking tryptophan and valine and all the amino acids are constraints, while the ulluco is more deficient in leucine, tryptophan and threonine.

With regard to vitamins and minerals, compared to the potato, there is a large amount of calcium and vitamin C contained in oca, vitamins A and C in isaño and vitamin B2 in oca and isaño, as well as lower values of phosphorus and niacin in all three Andean tubers. (Table 6).

Table 6. Content of energy, minerals and vitamins in oca, isaño, ulluco and potato (for 100 g of fresh matter)

	Oca[a]	Isaño[a]	Ulluco [a]	Potato[b]
Energy (kcal/g)	51	50	62	97
Minerals				
Calcium (mg)	22	12	3	10
Phosphorus (mg)	36	29	28	50
Iron (mg)	1,6	1,0	1,1	1,0
Vitamins				
A (m g equal retinol)	1.26	10.04	3.77	--
B1 (mg)	0.05	0.10	0.05	0.11
B2 (mg)	0.13	0.12	0.03	0.04
Niacin (mg)	0.43	0.67	0.20	1.5
C (mg)	38.40	77.50	11.50	20.0

[a] Ministry of Health/NHI/National Center of Food and Nutrition, 1996
[b] INCAP, 1975

The consumption of native potatoes and other tubers is very low in urban zones, meaning that these species have reduced markets and are quickly replaced by meals such as noodles and rice. To many farming zones, native potatoes and Andean tubers are practically the only production option. Despite this, the threat of losing these crops is higher due to the reduced market, as the crop is aimed at food security.

Potential of Andean Tubers

Non-traditional alternatives must be found for massive consumption of these species and in this way the agro-industry can be better represented. Pilot experiences of frozen pre-boiled native potato export and native chip potatoes show the potential for opening up new markets. Nevertheless, the task is a complex one and it must be worked out in a coordinated manner with the agro-industry.

Farmers in the high Andes come across very few market opportunities so growing native potatoes to meet a constant market demand will afford them great economic relief. Native potatoes are still grown using age-old methods that involve little or no use of pesticides.

Some native potato varieties possess good frying properties and also have attractive nutritional characteristics: yellow-fleshed varieties are high in vitamin C content, while red and purple pigments contain anthocianines and flavonoids-elements possessing antioxidant properties.

As these native potatoes have low water content, less energy is expended when fried. Native potato chips absorb up to 25 percent less oil than regular potato chips, which means fewer calories for consumers. And, because these potatoes are not peeled, the skin retains minerals and vitamins.

Thanks to the agro-industry, the other Andean tubers have important options. The elaboration of purees and oca flour has increased the possibilities of food diet use. In this way, Andean tubers can have an opportunity to contribute to improving food and also producers' incomes.

The genetic issue

Another potential contribution of Andean grains and tubers relates to genetics. It is fundamental to enhance the genetic programs in order to better understand the genomics and to better identify the potential contribution of genes to future food production.

It is impossible to think of how to make good use of the native species and of biodiversity, without an improvement program adapting the nutritional potential to the changeable demands of production and market systems. Unfortunately, in many countries of the Andean region, research funds have been reduced and, in others, research and improvement programs have been closed.

Grains and Andean tubers provide us with a series of opportunities to significantly improve food quality and quantity for rural and urban populations. Also, they can contribute to improving the income levels of farming families. It depends on us to make the best use of these opportunities.

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Annex

The food protein quality depends on its essential amino-acid content. FAO has pointed out that a protein is biologically complete when it contains all the essential amino acids in a quantity equal or superior to the one established for each amino acid in a protein or standard reference. Traditionally, milk and egg proteins were used as standard for amino acids. At present, the amino acid standard (aa) recommended to evaluate the biological quality of proteins for all ages, except for children less than one year, is based on pre-school amino acid requirements. (FAO/OMS/UNU, 1985; UNU/Cavendes Foundation, 1988).

The proteins that contain one or more amino acid constraints, that is, which are found in less proportion to the one established in the standard protein, are considered biologically incomplete, as they are not used in their total. The relation of the amino acid constraint found in less proportion regarding the amino acid itself in the standard protein, is denominated amino acid calculation (AC).

In Table 7 (below), the amino acid contents of Andean grain proteins are compared with the amino acid standard recommended.

Table 7. Calculation of amino acids (aa) of quinoa, cañihua and amaranth proteins

Amino acids	aa standard	Content of aa mg/g/protein			Calculation of aa (AC) %		
	m/g	Quinoa	Cañihua	Amaranth	Quinoa	Cañihua	Amaranth
Isoleucine	28	69	64	52	-	-	-
Leucine	66	67	58	46	-	88	70
Lisien	58	68	58	67	-	-	-
Methionine+ Cystine	25	33**	16***	35****	-	64	-
Phenylalanine+ Thyroxine	63	40	35*****	35	63	55	55
Threonine	34	45	47	51	-	-	-
Tryptophan	11	13	8	11	-	72	-
Valine	35	35	45	45	-	-	-
Histidine	19	-	-	-	-	-	-

Source: Rojas, W. and Scheldeman, X. 2005. Fact sheet of Andean grains.

Managing biodiversity for improved community well-being

by Setijati D. Sastrapradja[1]

Abstract

Indonesia is blessed with diversity not only in biological resources but also in the socio-cultural life of its people. Like many developing countries in the world, Indonesia has utilized its natural resources for national development while at the same time trying to conserve part of them for the future. However, recent political instability has had unfavorable impacts on Indonesia's biological diversity. The loss of biological diversity has greatly affected traditional communities whose livelihoods are dependent on such diversity. Suddenly, the natural environment they live in has changed. Competition with newcomers to their areas is now a reality and quite often the communities have become marginalized. Adaptation to change is unavoidable, hence the need for empowering the people with knowledge that can lead them to have options. One of the options is for them to manage biodiversity in their own areas, to fulfill their basic needs. Some communities are successful in their efforts to do so but some are not. The ecosystem approach has been identified at the global level as being the best approach to manage biodiversity holistically. Is this approach workable? What are the challenges to make it work at community level? What are the key factors contributing to the communities' success in managing biodiversity? Will it be sustainable? These questions will be elaborated here.

Despite many efforts to conserve biological resources at the global level, their rate of depletion has not been halted. Hence, there have been calls for a concerted effort to protect what is left in nature. Since the signing of the Convention on Biological Diversity (CBD) in Rio, awareness on the loss of biodiversity has increased significantly. However, a holistic approach to managing biodversity at all levels of governance, which has been promoted since then, has not been fully appreciated by all sectors of government, let alone by the private sector and community.

The Convention on Biological Diversity has an ideal objective: to reach a balance between conservation and utilization of biodiversity without neglecting the sharing of benefits from its utilization. Attractive as this objective may be, for those who are outside the conservation group, the Convention means nothing other than protecting nature. It is true that endangered species, such as elephants, rhinos, tigers and orang utan need to be protected from extinction; to non-conservationists, however, it is hard to understand why those species are considered more valuable than the human population inhabiting the same areas with them. In fact, such communities have lived in harmony with their surroundings and have utilized biodiversity for their livelihood needs from generation to generation.

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Many Parties to the CBD have national laws and regulations to protect their natural areas and the biological resources contained therein. But too often the human populations who live within and surrounding the protected areas are considered harmful to conservation. To ensure the safety of the protected areas, therefore, this human population needs to be relocated. Fortunately, with the CBD the role of communities in the conservation of biodiversity is emphasized; hence consideration for human beings within the concept of biodiversity. Without biodiversity, there will be no human population. On the other hand, with the ever-increasing number of humans on this planet, the existence of biodiversity is dependent on man.

That the livelihoods of many people still depend on biodiversity is a fact that can be readily observed in developing countries. There are many reasons to believe that such dependency will thrive with time, but there is also fear that this condition will soon be over, due to the impact of globalization. Indonesia is a very large developing country, which is rich not only in biodiversity but also in cultural diversity. This paper presents some examples of how biodiversity is managed at the local level, to provide for human needs in some areas of Indonesia. Even at that level, however, management of biodiversity is a complex matter involving many factors and interests operating together at any given time. A holistic approach is considered an appropriate way of unraveling the complexity. One question remains relevant to be discussed at this point: the sustainability of management efforts.

Dependency on biodiversity

Looking at the global map, it becomes obvious that biodiversity is not equally distributed on our planet. Although countries claim that they are rich in biodiversity, it cannot be denied that the tropical belt holds more biodiversity than other regions of the world. It also happens that the distribution of human population follows that of biodiversity. Thus, countries that are rich in biodiversity are usually also rich in human population. In the United Nations system, most of these countries are categorized as developing countries.

Development needs capital. Where there is abundance of biodiversity, this resource is readily available for harvest. Technologies to exploit it - either from forests, lakes, or sea - are easily accessible. Therefore, most developing countries have made use of this resource to finance their development. Although this resource is considered a renewable resource, sometimes its exploitation has exceeded its capacity to reproduce; then the renewable concept has its limitations.

When the CBD process started, Indonesia was listed as one of the mega-biodiverse countries. The 17,000 islands of Indonesia are spread along the equator occupying a space from west to east as wide as the United States of America. It is true that not all the islands are inhabitable but people are reported to live in some 3,000 of them. There are approximately 47 types of ecosystems with many subsystems in which people have adapted themselves for centuries and developed their relationship with nature. Such adaptation has resulted in the diversity of local races and cultures.

In terms of climate, Indonesia has only two seasons: the wet and the dry. The western part of Indonesia is generally wet and the eastern part is dry. In both regions, people have utilized whatever biodiversity is available there for food, firewood, shelter, and medicines. Geographical isolation has promoted traditional wisdom of harvesting biodiversity, developing agriculture and preparing food and medicines. The famous slash and burn agriculture in Kalimantan island and the multiple cropping system in Java island are examples of traditional agricultural practices which have been developed according to the natural setting in those areas. Both of these systems are considered environmentally sustainable if carried out properly.

In regions where water is insufficient for growing common staple crops such as rice, corn, and sweet potatoes, cassava is commonly grown instead. In some areas of Nusa Tenggara Timur province, the annual rainfall is about 300-600 mm and the rainy season lasts for approximately 3 months only. *Borassus* and *gewang* palms grow in abundance here. Both palms are tapped for their sap, which is useful for liquid carbohydrate, in addition to white corn, which can be grown only in the rainy season.

When isolation is broken

Indonesia proclaimed its independence in 1945, right after World War II, following 350 years under Dutch administration and 3 1/2 years of Japanese occupation. Although Indonesia is listed as one of the Vavilovian Centers, the majority of its food crops are introduced species. The indigenous crops, such as tuber crops, legumes, vegetables and fruits, remain in the hands of traditional farmers and have hardly been touched by modern breeding. Indonesia is also an exporter of estate crops such coffee, tea, cacao, vanilla. Again, in general, indigenous species that have estate crop value are harvested directly from the forests.

Mass exploitation of timber began late in 1960. Forest concessions were granted to both foreign and local firms. With modern equipment, logging went very rapidly. Apparently, traditional communities living within and surrounding the concession areas were overlooked in the agreement between the government and the concessionaires. Therefore, conflicts between loggers, the community, and government officers have colored logging operations. Some families have moved further into the forests to avoid conflict.

Industrial development in Indonesia began almost at the same time as the exploitation of forests. Unlike logging, industry has been developed in areas where infrastructure and labor were available. Therefore, agricultural lands surrounding the cities were the first areas to be converted for such a purpose. Moreover, the growth of housing complexes followed the process of industrialization. As was the case with the forest dwellers, some of the traditional farmers have been pushed further into remote rural areas and the process of marginalization of traditional communities is still on-going.

Those communities who decided to stay experienced a drastic change not only in their physical environment but in their basic needs also. If earlier they harvested

timber only for fulfilling their needs with regard to food, shelter and a bit of clothing, now their basic needs have expanded to include a radio, a motor cycle, a kerosene stove etc. The same holds true for the basic needs of traditional farmers. Children's education has also become an expansion of their basic needs.

The marginalized communities have faced a new challenge, which is represented by daily competition with newcomers. Linked to the process of mass exploitation of forests, land hunger groups from other islands have come in flocks to occupy the cleared forest areas, to settle and start up agricultural activities. These newcomers are usually more skilled and more motivated towards agricultural work than the locals. Moreover, the government program of relocation of people from Java to the outer islands has put greater pressure on traditional forest communities. The same situation has been faced by the marginalized farmers.

In dealing with traditional and local communities, the CBD provides an article (8j), which encourages national legislation to pay attention to them and whereby the third objective of the convention prevails. Article 8j has been discussed at length in many global and regional meetings; however its implementation is still far from satisfactory in Indonesia.

Land is the most precious property for traditional communities in general, especially for those who live within the forests and the surrounding areas. They have no certificates to prove that they own the land. In turn, no certificate means no security. Therefore, the provision of certificates by the government is progressing, although it is a very slow process.

While land ownership is still a problem, the severe environmental degradation has brought about water scarcity for agricultural practices. Nowadays, in many wet parts of Indonesia, flooding is a common scene during the rainy season, while in the dry season fresh water is almost unavailable. The same phenomena occur every year in what used to be forested land, such as in Kalimantan and Sumatera islands. Land rehabilitation and reforestation has been attempted. However, conflicts of various kinds hinder the progress.

For both land rehabilitation and reforestation, indigenous plant species are preferable. Many tree species planted are useful species - such as fruit trees, medicinal plants, and timbers. At the same time, crops are grown in the agro-forestry system so as to cater for the short-term benefits. In addition to the daily basic needs, planting species for income generation is attempted in order to enable families to have cash for additional needs. When a community has succeeded in planting trees and crops, it is only then that environmental value is appreciated.

The challenge to managing biodiversity

Protected areas are identified as the ideal way of conserving biodiversity at the national level. Once an area is identified to be protected, the legal system is in place to ensure its existence. Then the assumption is that biodiversity will be intact within it. It turns out that in Indonesia protected areas are as vulnerable as any other type of forests.

For nearly 3 decades, Indonesia enjoyed political stability (when President Suharto was in power). During that time, it was noted that forest exploitation went on without much consideration for sustainability. So did the conversion of forest areas to other land uses. However, from the conservation point of view, protected areas were relatively well-maintained.

Political instability began when President Suharto was forced to resign in 1998. With his fall, the era of democracy began. However, people have interpreted democracy as freedom without responsibility. With regard to protected areas, suddenly all those who craved to log timber or to trade animals considered protected areas as gold mines. In fact, in less then a decade, most of the protected areas in Indonesia have been vandalized. No matter how hard and loud is the cry of those who are concerned with conservation of biodiversity, nobody is able to stop the on-going destruction.

At the local level, many believe that community participation is a must if conservation is expected to work. Moreover, it is also common knowledge that one will actively participate in conservation if his/her livelihood is already secured. So the question is: is it possible to combine activities for improving community livelihoods and at the same time conserving biodiversity?

A lot of work has been done in the field of community development in Indonesia, which in some ways is associated with the environment. Some of these works are related to the improvement of livelihoods through agricultural practices. In a way, these activities are also related to the conservation of biodiversity. The following are examples of community empowerment, which has been carried out by various actors:

The Government: every year the Ministry of Environment selects individuals and a community who contributes significantly to the betterment of environment in his/her domain. An award called KALPATARU is given for that. Upon examining the recipients of these awards from 1986 to 2004, it is obvious that a community was willing to act together if, at the end of the activities, it received the benefits. A community in Gunung Kidul, Yogyakarta, successfully greened the area so that water is now flowing even in the dry season. To get a water supply they no longer need to walk for miles. Moreover, they can now plant indigenous crops for their own use.

Conservation Agency: There are a number of international non-governmental organizations dealing with biodiversity conservation in Indonesia. These are, among others, the WWF, TNC, CI, and Wetland International. They include community empowerment in their strategic plan. In 2001, TNC, for example, initiated the development of a Community Conservation Agreement (CCA) for a Better Future, by bringing together all stakeholders to discuss the management of Lore Lindu (Sulawesi) National Park. An Advisory Forum for Lore Lindu National Park was established at the provincial level. Then a Buffer Zone Forum was established at regency level. Next is the Village Conservation Council. The three groups, representing the interests of the users and of those who like to conserve Lore Lindu National Park, have signed the Community Conservation Agreement. By adopting

CCA, the local community has a greater role in managing their natural resources for their livelihoods and illegal loggers have been drastically reduced. This CCA was set up in five villages adjacent to Lore Lindu.

Local Non-Government Organizations: CBD has stimulated the establishment of many local non-governmental organizations dealing with biodiversity conservation. Among the well-known ones are Yayasan KEHATI, Komphalindo, and Rimbawan Muda Indonesia. KEHATI was established as a grant-providing foundation. Among the grants given to smaller organizations, KEHATI was successful in promoting the use of minor tuber crops, such as yam, cocoyam, canna, and elephant yam in Yogyakarta area. Communities in five villages in Yogyakarta are now convinced that by paying attention to the neglected crops they get enough to eat and also a small income, in addition to their basic needs. The elements contributing to the success were a local organization that acted as a facilitator, a number of farmers who were familiar with the crops, a scientific group who could provide the correct information needed, and the link to the market.

A somewhat similar success was achieved by KEHATI in promoting minor legumes, such as canavalia, velvet bean, wing bean, and various pinto beans. Fermented soya bean, *tempe*, is a popular food in the Jawanese culture. Actually, almost every bean can be fermented the way *tempe* is done. However, if processing is not carried out correctly, the fermented products may become poisonous. These beans, which were almost forgotten by local farmers, are now flourishing although some additional work needs to be done. Again, the above elements need to be in place before farmers become eager to join the crowd.

Community-Based Organization: Islam has the largest number of followers in Indonesia. The way in which Islam is taught differs from place to place. The school for Islamic studies at village level is called *pesantren*. The founder of each *pesantren* is referred to as *kiai*, the most respected leader. It has been proved that collaboration with these leaders regarding management of biodiversity is very fruitful. LIPI, the Indonesian Institute of Sciences, has a program on the utilization of local biodiversity for improving farmers' welfare. Two kiai were contacted, one is in Garut and the other is in Ciamis. At first, the dialogue between LIPI and the kiai went slowly, but once they understood the goal, they agreed to be the executing agents. In Garut, LIPI has promoted land rehabilitation by planting trees, and in Ciamis, agrobiodiversity is the choice. The activities in both areas have just started. Both kiai are enthusiastic about managing biodiversity.

Private sector: Indonesia is known for its medicinal plants. For centuries, people in Java have developed *jamu*, a mixture of many medicinal plants to be consumed for curing minor ailments. Most of the species used in *jamu* come from backyards or are directly harvested from forests. There are now about 20 or so species which, according to the *jamu* companies, are now becoming rare. Thus, a special effort has to be made in promoting their cultivation. Farmers are encouraged to plant these species but the planting materials are not accessible. Some of the *jamu* companies have partnered with farmers to plant the rest of the species needed in the *jamu* business. In such cases, farmers are trained to plant and then to process correctly.

The company is prepared to buy the raw materials if the standard is met. In this way, the market is secured and farmers see the incentives for producing good raw materials.

From the examples given above, it is obvious that conservation of biodiversity at local level is dependent on its uses. It means that the benefits from caring about biodiversity should come first and only then conservation follows. The key elements contributing to motivating communities to act vary from place to place. Whether such a success can be replicable in another place or not, it is yet too early to say. The same holds true regarding the question of sustainability of management.

Global vision to local actions

It is already five years since the declaration of the Millennium Development Goals and almost three years since the World Summit on Sustainable Development. Meanwhile, biodiversity conservation itself is entering the 13th year of the CBD. It was agreed that by 2010 the rate of biodiversity loss should be significantly reduced. It is also the final year of the Millennium Ecosystem Assessment undertaking. As a country, Indonesia is alerted that all global commitments need to be translated into national activities. Not all commitments have follow-up actions nationally.

Among the many decisions taken by the Conference of the Parties to the CBD, the ecosystem approach in managing biodiversity is quite attractive. Not only does this approach cover the much-desired holistic approach to implementing the strategic plan of national development, its 12 principles contain a forward-looking view. However, upon reading them carefully, it is evident that many of the principles are too idealistic to be practicable. Principle 12, for example, states that the ecosystem approach should involve all relevant sectors of society and scientific disciplines. While it is true that, ideally, all sectors should be involved, it is something that is really hard to implement.

It has been mentioned above that the CBD is in its 13th year. The biodiversity loss has not been halted, nor has the direction been reversed. Although it is true that there is growing awareness of biodiversity loss, the size of the circle of those who are really active in doing what is meant to be done remains the same. The challenge that faces us today is how to enlarge that circle.

From both technical and scientific viewpoints, both conservation and utilization of biodiversity are well-based. The third objective of the CBD covers more subjective matters, such as the socio-cultural consideration. In the real world, biodiversity conservation is closely linked to where biodiversity exists. It means that the community within that area is the major player in the conservation activities. Therefore, the socio-cultural aspects of biodiversity should be thoroughly thought-out so that local communities can be motivated and later on mobilized to manage it in a sustainable manner.

It must be realized that there is no easy way to manage biodiversity. Even at the local level, which is generally on a much smaller scale than at the national level, it is not easy to further cooperation among the actors or stakeholders. A holistic

or ecosystem approach is quite attractive and also reasonable to adopt. But in this world, seeking cooperation takes time and is sometimes doomed to failure. However, all of us need to have an optimistic outlook, otherwise we just see a dead end at the conclusion of our long journey.

Abbreviations and Acronyms

CBD Convention on Biological Diversity
CCA Community Conservation Agreement
NGO Non-Governmental Organization
LIPI Indonesian Institute of Sciences

The Market Map: a framework for linking farmers to markets

by A. Griffith, M. Albu and A. Rob[1]

Introduction

In order to enhance and maintain biodiversity, value should be attributed to the indigenous knowledge, plant and animal species, and skills that create the environment in which biodiversity is nurtured and sustained. Some of the poorest communities in the world depend on their ability to realize that value, which can be both intrinsic and economic. Rural poverty reduction policies and strategies that aim to create sustainable livelihoods for the rural poor are being undermined by the loss of species and the degradation of ecosystems, which are accelerating at alarming rates. (Achim Steiner, 2004). The lack of progress towards the Millennium Development Goals points to an urgent need to address declining incomes. Small-scale farmers, growers and landless harvesters are connected to market channels that could have the potential to provide a better future. Those responsible for policy and practice need to become more 'market literate' in their approach. Market 'pull' is arguably one of the most important factors driving the production or preservation of important species; conversely, it can lead to degradation. Trade regulation is vital but too often results in the concentration of power in the market chain. What is needed is a better understanding of how market systems work, so as to determine where interventions should be directed. Many development programmes seek to address market 'failures' by, for example, stimulating production (addressing supply side constraints) or finding new market links and opportunities (demand side constraints). It is important to look at the whole picture, and to involve the market chain actors in developing the innovative ideas that will improve the situation of producers in the chain. This paper describes a process of mapping the market and illustrates some of the challenges and issues that need to be addressed in order to make markets work for the poor. These include:

- Building linkages and enhancing trust between actors in the market chain (Best et al., 2005);
- Supporting small-scale producers to associate, collaborate and coordinate to achieve economies of scale in their transactions with buyers or suppliers (Bienabe and Sautier, 2005);
- Making channels of information and market intelligence accessible to rural producers (Marter, 2005); and
- Enabling rural producers to understand and better satisfy the product, process or delivery standards required by buyers (Walker, 2005).

[1]ITDG Markets and Livelihoods Team - Alison Griffith and Mike Albu are based in the UK; Abdur Rob is based in Bangladesh.

The Market Map framework described in Section 2 below, encourages rural development organizations to become 'market literate'. It provides a framework for looking at the market system and designing targeted and appropriate interventions to improve the functioning of that system. In Section 3 we share the experience of operationalizing the Market Map with the example of a herbal products project in Kenya. The final section explores some of the policy implications at the micro, meso and macro levels.

The Market Map

The Market Map serves two purposes. For the policy maker and rural development planner, it is a conceptual framework for thinking about the commercial and institutional environment in which small-scale producers (including smallholder farmers) operate. For the practitioner, it is a practical and potentially participatory tool that can be used to represent and communicate knowledge about specific producers, their market-chains, institutional environments and service needs.

The market-literate approach illustrated by the Market Map provides development practitioners with a conceptual and operational tool to facilitate pro-poor growth

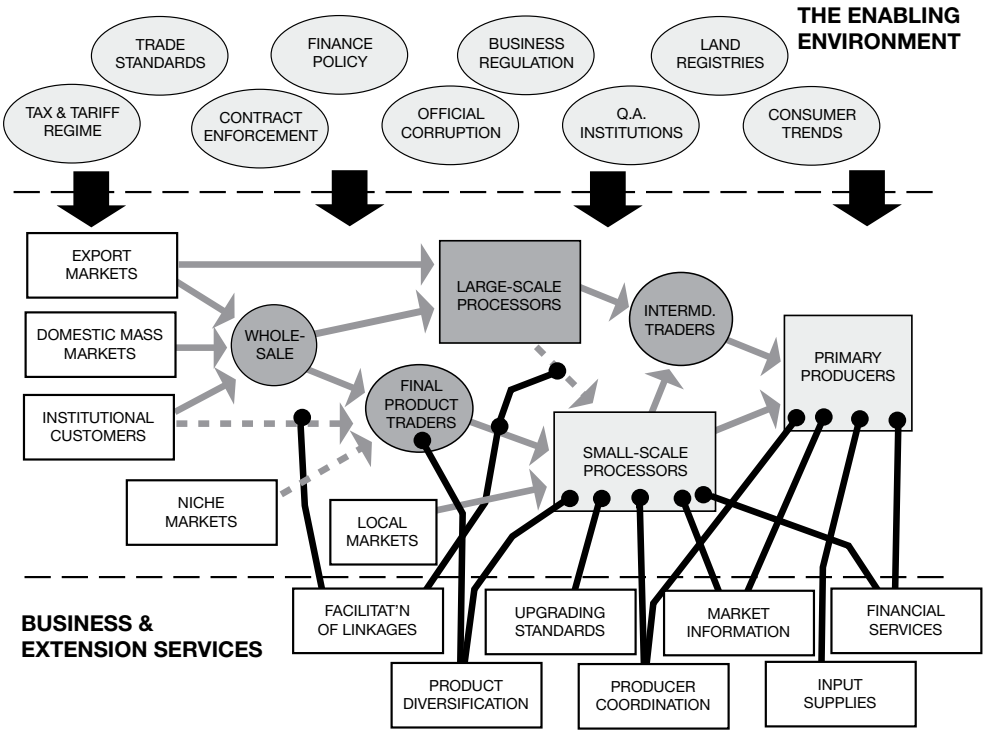

Figure 1. The Market Map (a generic schematic)

in rural areas and to close the wealth gap between rich and poor. The process of elaborating the Market Map, if conducted in a participatory manner, can be a vital intervention in itself - directly improving linkages and relationships between market-chain actors, and preparing the ground for introducing or generating innovation in products, processes and market access.

Antecedents of the Market Map

One of the Market Map's strengths is that it is the product of an inter-disciplinary initiative drawing together practitioners from several fields, including small enterprise development, natural resource management, fair trade, agricultural marketing and community development. We believe the Market Map will be particularly useful in broad-based multidisciplinary programmes, where winning adherence to a coherent shared conceptual framework can often be very difficult.

ITDG developed the Market Map initially at a workshop involving international staff from Africa, Latin America and South Asia, in 2002. Since then the framework has been adopted and adapted as a training tool by organisations such as TraidCraft and Oxfam. Readers will almost certainly recognize aspects of other tools and approaches in this work. The formative ideas that have contributed to our thinking include:

- Subsector Analysis, as originally conceived (Haggblade and Gamser, 1991) and subsequently adapted (Lusby and Panlibuton, 2004);
- The Sustainable Livelihoods framework approach[2] and the recognition that in the conceptualisation and application of 'livelihood approaches' there is often a lack of emphasis on markets and their roles in livelihood development and poverty reduction (Lusby and Panlibuton, 2004);
- Value-chain Analysis (Kaplinsky, 2000), particularly participatory approaches (Mayoux, 2003); and
- The Integrated Agro-enterprise Project methodology used by CIAT and discussed by one of the thematic papers at this seminar (Best et al., 2005).

The Market Map: an initial orientation

The Market Map is designed to be used after the identification of particular product groups (or subsectors) that appear to offer growth potential for poor producers/ smallholders. Appropriate criteria for selecting appropriate products or subsectors have been described extensively by others, such as CIAT and AFE, so we will not cover this here. The Market Map is made up of three inter-linked components (see Figure 1).

The market chain actors

The central component of the framework is constructed by mapping the economic actors who actually own and transact a particular product as it moves through the

[2] For example, DfID's version at Livelihoods Connect website www.livelihoods.org

market chain from primary producer to final consumer: smallholders and larger-scale producers, traders, processors, transporters, wholesalers, retailers etc.

In many cases, the market-chain comprises more than one channel and these channels can also supply more than one final market. A comprehensive mapping therefore describes interacting and *competing* channels (including those that perhaps do not involve smallholders at all) and the variety of final markets into which these connect. As far as possible, information about product volumes and values, and numbers of enterprises or livelihoods supported at each point in the chain, is overlaid on the map – as for a standard subsector analysis (Haggblade and Gamser, 1991). Information about patterns and trends in the data is also incorporated.

Defying convention, the typified framework schematic diagram above reverses the direction of the chain. It shows the flow of *income* from markets along the chain to primary producers, rather than (as is conventional) the flow of *goods* in the opposite direction. This counter-intuitivism is introduced deliberately to emphasize a demand-led perspective. It provokes users of the map to consider how market chain linkages and functions can be improved so as to facilitate the flow of income to target producers who are perhaps furthest from end-markets. Instead of asking "how can these smallholder farmers get more income for this crop?", it suggests that we ask "how might a greater share of (say) urban expenditure on this product reach these farmers?"

A critical early step in applying the Market Map lies in selecting which markets and channels offer the best prospects for enhancing poor producers' livelihoods. This decision – informed by an overview of the prospects and relationships between competing channels – determines the focus applied to developing the Market Map further. At this stage, the potential for establishing new linkages in the market chain may also be considered.

Once the potential of a specific market channel (or a number of alternative channels) has been identified the analysis moves into a more detailed consideration of how value accumulates along the market chain. By better understanding the contribution each actor in the chain brings to the product, the aim is to identify inefficiencies, inequities and losses which could be remedied, or added-value which could be captured by poor producers in particular. A comprehensive market chain analysis will explore how the chain is 'governed', since this influences how profit margins are divided up through the chain – for example, which actors or other institutions a) define the conditions for participation in the chain, b) ensure compliance with these rules, and c) provide assistance with regard to meeting these rules.

While many market chains are characterized by inequitable relationships between actors, a clear objective of the Market Map approach is to help stakeholders realize mutual benefits by improving the 'systemic efficiency' of the chain. Helping stakeholders become more aware of the functions and processes that are needed along the chain in order to satisfy more lucrative or reliable markets, is key to this.

The enabling environment

The second component of the Market Map is a charting of the critical factors and trends that are shaping the market chain environment and operating conditions but

that may be amenable to change. These 'enabling environment' factors are generated by structures (national and local authorities, research agencies etc.) and institutions (policies, regulations and practices) that are beyond the direct control of economic actors in the market chain.

The purpose of charting this enabling environment is not simply to map the *status quo,* but to understand the trends that are affecting the entire market chain, and examine the powers and interests that are driving change. This knowledge can help determine avenues and opportunities for realistic action, lobbying and policy entrepreneurship.

In thinking about the very wide range of factors, it may be useful to distinguish those that relate to *market demand*, meaning prices, quantities, qualities and timeliness of supplies required by buyers; those that bear on *transformation* activities, meaning costs of producing, processing, storing and moving produce; and those that affect *transaction* activities, meaning costs of doing business (Kydd, 2002). The latter include costs such as:

- Contracting: building linkages, agreeing terms, monitoring performance and enforcing contracts
- Securing Finance: cost of providing (or not being able to provide) collateral
- Legal Recognition: licensing and business formalities
- Quality Assurance: information and skills needed to understand, monitor and certify adherence to the buyer's standards

In using the Market Map, specific factors, issues and trends that are identified as significant influences on the market-chain operations, are recorded above the market-chain itself. Priority is given to identifying and unpacking issues that are likely to cause significant impact on the market chain operations or are relatively amenable to change themselves.

As before, a key objective in applying the Market Map approach is to help market chain stakeholders become more aware of these factors and trends. Action to improve the enabling environment usually depends on concerted lobbying, coordinated campaigns or advocacy.

Clearly, if the process of charting the enabling environment is participatory, it is more likely to build trust, coordination and collaboration between actors in the market-chain required to achieve this.

Business and extension services

The third component of the Market Map framework is concerned with mapping the services that support, or could potentially support, the market chain's overall efficiency. The range of services that can potentially add value is extensive and includes:

- Input supplies (seeds, livestock, fertilizers etc.)
- Market information (prices, trends, buyers, suppliers)
- Financial services (such as credit, savings or insurance)
- Transport services
- Quality assurance - monitoring and accreditation

- Technical expertise and business advice
- Veterinary services
- Support for product development and diversification

Service delivery mechanisms can differ substantially. In exploring what already exists, it is important to recognise that the options are not confined to conventional government *extension services* and private *fee-based services* or input providers. There are also *embedded services*, where services are incorporated within a commercial transaction for another product – e.g. pest control advice offered by a trader to a contract farmer. And finally there are *informally-provided services* where the service, such as information or advice, is negotiated through social networks and reciprocal relationships, which may be 'invisible' to outsiders (Hitchins et al., 2004).

At this stage, mapping 'services' involves identifying particular service needs and their locations within the market-chain in order to get an overall picture of the opportunities for using services to improve market-chain efficiency or equity. This mapping is a precursor to subsequently assessing the most appropriate mechanisms for delivery of services, in terms of outreach, sustainability and cost-effectiveness.

As a direct result of the emergence of the BDS market development field, significant work has been done to elaborate practical methods of assessing the market for services. BDS market development approaches have direct relevance even to rural producers in weak economic environments (Hitchens et al., 2004). These methods enable one to gauge what services are potentially viable and understand the demand or supply-side constraints that have to be addressed to develop a vibrant and sustainable market.

The Market Map and operational challenges

Within ITDG, the Market Map has been an invaluable framework for strategic development of the international programme "Making Markets Work for the Poor". It has given us a common language and approach to develop coherent programme objectives. Operationalizing it at project level has been challenging for the international team, since using the Market Map in the design and implementation of projects involves adopting a new approach and inevitably it takes time to build capacity. Progress is being made, evident in a recent project in Kenya, and this section benefits from the emerging lessons of that work. By sharing the Market Map with other organizations, ITDG has also learned from its application in different ways.

Initial analysis and mapping

As discussed earlier, one of the strengths (and indeed the primary purpose) of the Market Map is that it lends itself to participatory analysis of market chains. For this approach to be effective, a two-stage analytical process is helpful:

- Initial market mapping by the facilitator - producing a Market Map which shows the market chain(s) actors, the services required by the market chain actors (actual services and potential) and the enabling environment issues. One

way of gathering information is to create an 'Interest Group' which consists of stakeholders and key informants. The information gathered at this stage is used to facilitate the participatory market chain analysis; and

- Participatory Market Chain Analysis (PMCA), bringing together the specific actors in the chain.

In Kenya, a new project in the herbal products sector is using the framework to explore alternative livelihood options for marginalized pastoralists (see Box 1). It is a Learning Project researching approaches that enable producers and other market chain actors to identify solutions to market chain issues, regulatory constraints and service needs.

Context – improving livelihoods of marginalized pastoralists

Pastoralists in Northern Kenya have been facing the long-term erosion of their traditional livelihoods as a result of declining livestock prices, environmental degradation and conflict. Technology-led solutions have been failing to improve livelihoods. However, the areas in question contain potentially valuable natural resources, including herbal products showing increasing demand in export markets. In 2004, a project was initiated to learn about approaches for successfully integrating marginalized producers into viable market chains. For the first phase, the project selected an area, West Pokot, which characterizes typical aspects of the product sector. The initial mapping exercise by the project team has highlighted a number of challenges and issues at each of the three levels of the market map.

Improving linkages in the market chain

The project team carried out preliminary research, which identified herbal products as a viable and growing sub-sector. Further research identified a product group – aloe – as important to the livelihoods of communities, and there is growing demand on world markets. The project approach is to:

- Enable producers in West Pokot to establish a 'Market Opportunity Group';
- Facilitate further market exploration to select the most promising market channels; and
- Conduct a PMCA (with market actors in the selected channels) to identify and tackle bottlenecks and opportunities.

Challenges include addressing the fact that:

- Harvesters of aloe are disparate and disorganized;
- Harvesters have misconceptions about what happens to their product; its value, destination;
- Market chain actors are very secretive about the trade because of the unresolved regulatory issues.

Creating an enabling environment

Key issues have been identified by interviewing key informants (including market chain actors), producing a preliminary analysis of the local policy and regulating issues that are preventing effective participation by the communities in the trade of

aloe. In addition, research on international trade issues (regulations, barriers) has been initiated. The following are examples of issues emerging from the analysis so far:

Trade restrictions – CITES requirement on aloe export since 1999 has pushed the trade 'underground' and considerably reduced the earning potential. All exports now go illegally via South Africa, 'hidden' with other products. The so-called 'Presidential Ban', which never actually became law, has created further confusion making market chain actors even more secretive.

Corruption is endemic throughout the chain, adding costs and creating distortions of power and interests – for example, boilers pay bribes to local chiefs, which enables them to negotiate lower prices (chiefs negotiate prices on behalf of harvesters).

Prejudice against Somali traders causes a high degree of mistrust and lack of co-operation.

Access to better business services

Initial analysis has indicated that some embedded services exist in the chain, for example:

- Quality checking – boilers have devised a system to test the sap before purchase (based on its absorption); they also advise on best harvesting methods.
- Storage and bulking – urban traders buy regularly from boilers, taking higher quantities in the rainy season.
- Market information – an order from the exporter triggers action in the chain and information is passed down.
- Transport – market chain actors absorb the cost of transport.

Additional services which actors could require:

- Harvester co-ordination – the current arrangement of relying on the local chief leaves them vulnerable to exploitation.
- Technical extension services to harvesters, such as sustainable harvesting techniques (to protect supply since the source is getting depleted in many areas); Advice on harvesting methods to improve quality, such as technology which extracts sap through gravity.
- Energy-efficient technology for boiling, to reduce fuel costs.
- Environmental impact assessment is required by other stakeholders (such as the government environment agency NEMA).

The project team produced the initial analysis, created a Market Map (Figure 2) and are now proceeding to PMCA, where the mapping exercise will be completed with market chain actors who will develop solutions and innovations.

The challenges encountered during the mapping phase have included:

- Developing the capacity of the project team to undertake the analysis – the approach was 'learning by doing'.
- Time and resources required to collate information about a market chain that stretches from remote Northern Kenya to Mombasa and onwards to South Africa.
- Building the trust of local stakeholders (particularly important because of the on-going conflict in the area).

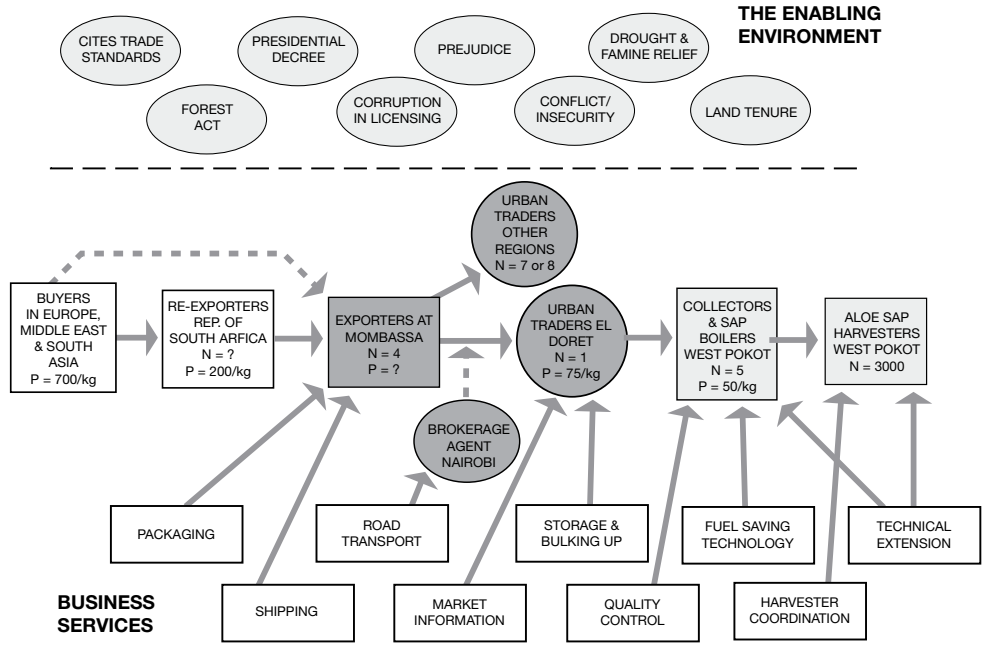

Figure 2. Aloe Market Chain in West Pokot, Kenya

- Managing expectations of not only the market chain actors but also other stakeholders (such as in the Interest Group). Producers often have an expectation of immediate benefits, such as higher prices.

The initial mapping of the aloe market chain enabled the project team to develop a systemic orientation and, more practically, prepare for the PMCA exercise. A key learning point that emerged is that investment in this stage is important since subsequent interventions will be more targeted and strategic.

Challenges and innovative approaches in participatory market chain analysis

PMCA is at the heart of operationalizing the Market Map. It shifts from being an abstract framework and becomes a practical tool that can facilitate improved efficiency (such as better co-ordination), innovation and improved trust within the market chain. However, many practitioners are hesitant to try a PMCA approach because they believe that it will be difficult, if not impossible, to get market chain actors together to achieve mutual objectives. Their reticence is not unfounded. Bringing together disparate, competing, demanding business people is undoubtedly challenging. The section shares some ideas on what the challenges are likely to be and offers suggestions on how to address those challenges.

i) Attracting market chain actors – find a 'hook'

Very few market chain actors (particularly those at the market end of the chain) are likely to attend a 'development project' meeting. They will be suspicious of the motives – for example, they might suspect pressure to give their suppliers a higher price. By identifying very specific common issues that concern all market actors, facilitators can turn these into an 'offer' that will 'hook' actors into the process. Even if they are initially wary, they will be more likely to attend if they can see a commercial benefit. Ideally, the 'offer' should be achievable and directly relate to specific market chain issues. Vague and overly ambitious offers, such as 'finding new markets' may be less likely to keep actors engaged.

ii) Balance of power in the chain

The actual and perceived imbalance of power within the value chain can be an impediment to participatory analysis. The perception that all the power is held by actors at the market-end of the chain is commonly held by facilitators, and most often by producers and small traders too. They tend to believe that such an exercise would be a 'waste of time' because either the 'big players' would not be persuaded to come or, if they did, they would dominate the process.

This perception is not unfounded of course but there are lessons emerging on how to create meaningful engagement that lead to positive changes. The more powerful actors in the chain often rely on the others further down to provide a high quality product, on time and to order, and they may need to invest so as to make this happen efficiently.

iii) Mistrust between actors

Building up trust between market actors is important to facilitate open sharing of information. This is likely to take time and there may be a challenge to overcome hostility between different groups of actors. Possible strategies include:

- Facilitators to visit and interview individual market actors as a preparation for bringing the different groups together;
- Facilitators to adopt an incremental, iterative approach: engaging on one issue helps to build trust, information exchange and thus further analysis of more complex or contentious issues.

iv) Physical limitations to effective PMCA

When market chains stretch over long distances, facilitators should consider several exercises in different places.

The aloe market chain is dislocated with actors spread over 1200 km, from remote Northern Kenya to the coast, so the project is addressing this problem by holding initial partial market chain participatory meetings between interacting actors:

- Harvesters and boilers
- Boilers and traders/central agents
- Central agents and exporters.

The segments of the market chain overlap so, for example, boilers will interact with both harvest and urban traders. The next step is to bring as many representatives

of all groups to a central location to explore solutions and innovations to the issues they have identified in their market chain sub-section. This incremental approach also builds trust (see above).

v) Minimizing the impact of external influence, meaning those not in the chain

As far as possible it is important to try to minimize the 'visibility' of an NGO's role as facilitator. Possible strategies could be to get key actors with power and influence who are well-organized themselves (for example, exporters' federation) to organize discussions. However, it would be important to mitigate the danger of introducing bias. Similarly it may be possible to exploit government agencies that have a mandate to promote particular sub-sectors, although the facilitator would need to be aware of perceptions of 'political' bias.

vi) Advice for facilitators of PMCA workshops

Facilitators should:

- Have a good overview / information about the sub-sector in order to anticipate conflicts and grievances, but beware of pre-empting what the map will look like.
- Work ahead to 'sell' the advantages of participatory analysis to different market actors.
- Anticipate complaints and grievances of particular groups that may dominate the interactions, so negotiate 'norms' for running workshops through individual mediation – for example, establishing clear agendas in advance.
- Understand that market actors may expect rapid results or changes as a result of the analysis process so try to ensure that interactions lead to rapid activities – gaining credibility for the process.
- Avoid being seen as an 'extractive' process – drawing out knowledge from market actors, without giving much back.

Developing 'in house' capacity for market mapping and PMCA

Market Mapping and the associated PMCA approach is likely to require investment in developing the necessary skills and experience within an organization, particularly one that is focused on poverty alleviation and is used to directing its focus towards the needs of poor communities. In the first instance, there may be a need to explore misconceptions and/or a lack of understanding about how market chains work. To address this, an interactive training tool for programme and field staff, called the *Value Chain Game* has been developed by Traidcraft and Oxfam, using the framework of the Market Map. The purpose of the training tool is to 'unpack' the framework for project managers and show how a holistic approach to market development involves a full understanding of all the actors in a value chain, and the issues that affect them, in terms of services and the environment in which they operate.

In some agencies there has been a tendency to promote alternative value chains, often on the premise that 'exploitative' middlemen are the primary reason for inadequate incomes at producer level. The training tool can be an important part in challenging that perception. It may also be necessary to challenge the inclination of

some agencies to conduct the full analysis (often employing consultants for the task) so that they can decide what the interventions should be. In determining specific interventions, a participatory approach has significant advantages (as discussed in Section 2), and it should be expected that the extra resources required will be justified by the quality of information and interventions that the process yields.

PMCA builds on the participation and facilitation skills that most development staff will already have acquired in other work, but with different actors. Beginning with the premise that it is the participants themselves who can most appropriately develop solutions and innovations, will be a familiar and comfortable approach (possibly unlike business consultants who are more likely to 'problem solve' on behalf of the market chain actors). Project staff may lack confidence in front of the bigger, more commercial actors in the chain but this can be assisted by employing strategies indicating that they have positive reasons for engagement, taking an incremental approach to build up relationships.

Developing sustainable service markets

A challenge for practitioners is how to gather accurate information about weak service markets so as to make assessments that will stimulate the supply of services that are in demand. The PMCA is potentially a valuable way to conduct market assessment, particularly in market chains where there is usually a high incidence of embedded service provision. Practitioners are using different strategies to gather information in weak markets, including focused interviews with market actors on problems, potential solutions, and business benefits that services can provide, rather than on actual services. This can then lead to product concept tests for new services in a group discussion setting. The Market Map framework and subsequent PMCA process could be a way to achieve this engagement, which leads to new services or service packaging.

Challenges at the micro, meso and macro-levels

There are a number of implications and challenges in adopting the market map concept for policy-makers, organizations and programme managers concerned with pro-poor agricultural development. The implications can be considered at three levels:

- Micro level: concerning the strategies, alliances and practices of small-holder farmers, other producers and intermediaries, economic actors in the market chain
- Meso level: concerning the strategies and operational structures of rural development research institutions, government rural development agencies and NGOs
- Macro level: concerning broad agricultural and rural development policy, the operational approaches of multinational agencies and national ministries

Challenges for resource-poor producers and their economic partners (micro-level)

The market map concept poses some major challenges for poor producers (smallholder farmers), other economic actors in market-chains, service providers and other agencies working to encourage pro-poor growth. It emphasizes that their fortunes are bound up

with the capability of the whole market chain to respond (systemically) in a pro-active and agile manner to changes in the competitive environment, and emerging market signals (Best et al., 2005). Successful market-chains that sustain, grow and generate income for producers will be ones that can find effective mechanisms for:

- Collaborating in production, procurement of inputs and services, and marketing activities.
- Investing in market intelligence capabilities and market-information systems.
- Communicating with and influencing the meso-level institutions that provide support services and infrastructure, or that can influence the business environment.

Market mapping and participatory market chain analyses provide information about what is constraining the development of a particular market chain. In order to tackle those constraints and bring about systemic change, agencies need to develop communication strategies that target decision makers.

Challenges for rural development agencies and research institutions (meso-level)

At the meso level, a market literate approach requires institutionalizing a new way of thinking throughout organizations. Many meso-level organizations, such as NGOs, are shifting from a production focus to a market focus and this will require a new set of priorities. This commitment should lead to changes in allocation of resources. Equipping staff to adapt to a market orientation is a process that will take time and needs a commitment at all levels of an organization. Priorities for organizations aiming to develop successful market-chains that sustain, grow and generate income for producers, include:

- Using a systematic analysis of market needs and opportunities.

A framework, such as the market-map, used in different ways can assist organizations to design market- literate programmes, projects and interventions.

- Building capacity (people, skills and structures) for market-literate working practices.

In the aloe example, it was noted that a considerable challenge was building the capacity of the project team to conduct the analysis and facilitate the PMCA. Many organizations adopt a "learning by doing" approach, which has some drawbacks. It is important for practitioners to learn from others and also to invest in developing capacity to understand and apply a market-literate approach (including the use of appropriate analytical and participatory tools and methods).

- Promote an inter-disciplinary ethos.

It is understandable that new approaches in organizations may be received with hesitance and scepticism. It is important to value and maintain the skills in,

for example, natural resource management, but to complement them with stronger business and market skills.

- Co-ordinate and collaborate.

It is important to have a shared vision and objectives, for example, regarding a territory or sub-sector (Best et al., 2005) to ensure that the approach to market development is consistent (so that interventions to build a market are not undermined) and to negate as far as possible gaps in, say, service provision. Collaboration also promotes learning, which is key in a relatively new area. This can be formalized, through learning alliances or project partnerships, or it can be less formal, creating networks of those developing expertise in the area.

Challenges for governments and donor policy (macro-level)

At the macro-level, recognition of the market-literacy concept involves an orientation and commitment similar to that described for meso-level organizations above. Ferrand et al., (2004) set out four clear priorities for governments and donors that involve embedding a more market literate approach.

While there are no easy formulae, there are clear priorities for organizations seeking to make sense of MMW4P in their work:

- *Recognize MMW4P as a key objective*: put MMW4P explicitly at the heart of organizations' strategies and aims; this is the first step to operationalization.
- *Understand the key stages in MMW4P as an approach*: build a thorough understanding of markets; develop a transparent (and shared) picture of how markets could work in the future; and ground interventions in these analyses. This is the essence of the MMW4P approach – and in doing so, to take cognisance of emerging principles of good practice.
- *Internalize MMW4P*: take the broad objective and approach into organizations' realities. Using different tools (some of which are listed at the end of this paper), begin the process of aligning organizations' work with a credible view of market development.
- *Engage with other players on this basis*: MMW4P requires that different players in markets know their respective roles and commit themselves to undertaking these effectively. Markets cannot be built by one organization alone.

Lessons for governments and donors include the following observations:

- By introducing and emphasizing 'market-literacy' in rural poverty-reduction policy, it is possible - even necessary - to make market analysis a prerequisite in agricultural research initiatives and rural development programmes (so that the analysis becomes as common-place and well-established as environmental and social impact assessments).
- Embedding a market literate approach requires investment and allocation of resources to develop the necessary skills.
- Donors must be willing to lose some control over project design – such as determining the specific interventions. These will not be known at the start

of the project if the Market Map approach (or similar) is taken, with full participation.

- Investment in the analytical stage and in PMCA is important since subsequent interventions are more strategic and targeted. Donors should encourage, rather than discourage, programmes that plan for this type of analysis.
- Consistency of approach is important. As Best et al., (2005) point out "*confidence is strained when conflicting approaches are espoused among and even within donor… agencies*".
- Encourage inclusion of government vis-à-vis enabling environment issues.
- Developing country governments need to be committed to confront inequality and find solutions (such as to corruption) – need global institutions such as the World Bank, UN, WTO to tackle these issues – so that all move towards mutual understanding about the problems and how to address them (Best et al., 2005).

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Abbreviations and Acronyms

CBD	Convention on Biological Diversity
IARC	International Agricultural Research Centre(s)
IPR	Intellectual Property Rights
IAN	Instituto Agronómico Nacional
ITDG	Intermediate Technology Development Group
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
GI	Geographic Indication(s)
GMO	Genetically manipulated organisms
LARI	Lebanese Agricultural Research Institute
MMW4P	Making Markets Work for the Poor
NEMA	National Environment Management Authority
PBR	Plant breeders' rights
PEDIGREA	Participatory Enhancement and Development of Genetic Resources in Asia
PGRFA	Plant genetic resources for food and agriculture
PVP	Plant Variety Protection
UPOV	International Union for the Protection of New Varieties of Plants
PMCA	Purple Martin Conservation Association
TRIPS	Trade-Related Aspects of Intellectual Property Rights
WIPO	World Intellectual Property Organization
USDA	United States Department of Agriculture

International policies dealing with biodiversity and their impact on the achievement of Millennium Development Goals

by M. Hermann[1], G. Moore[2] and M. Halewood[3]

Abstract

This paper assesses how international and regional regulatory frameworks affecting access to genetic resources and marketing of 'diversity products' contribute to the Millennium Development Goals (MDGs), particularly those dealing with food security, nutrition, and reduced poverty.

The authors note that plant genetic resources for food and agriculture (PGRFA) are key to research and crop improvement programs whose objectives are the reduction of hunger and poverty, and increased environmental sustainability. The conditions-precedent for making the most beneficial uses of PGRFA are that they are readily available at low cost to breeders and researchers around the world. The history of crop domestication, improvement and migration confirms that all countries are interdependent in their reliance on PGRFA for their food security. The authors argue that regulations affecting access to PGRFA should respect and build upon appreciation of this interdependence. The International Treaty for Plant Genetic Resources for Food and Agriculture (the Treaty) is designed to create an enabling environment for using PGRFA for research, breeding, conservation and production. The authors argue in favour of leaving room to eventually expand the list of crops and forages that are included in the Treaty's multilateral system of exchange and benefit sharing (or alternatively, creating regional multilateral arrangements for access and benefit sharing concerning materials not currently included in the Treaty's list of crops and forages).

The authors note that food safety standards, such as those mandated by the EU Novel Food Regulation (NFR) (EU Regulation 258/97), require an increasingly stringent pre-market safety assessment for diverse traditional food products from developing countries. The NFR has emerged as a non-tariff barrier for trade in food items that are often derived from under-utilized biodiversity and are viewed as highly promising but 'exotic' from the EU perspective. The considerable burden of proof for the innocuousness of these products has discouraged investment in supply chains

[1] IPGRI, Colombia
[2] IPGRI, Rome
[3] IPGRI, Rome

and market development. There is still little awareness of the potential threat which the NFR poses to income generation in developing countries and to poor farmers' livelihoods. This paper outlines a number of considerations that, in the interest of enhanced trade in sustainably produced biodiversity products from developing countries and diet diversification within the EU, should be taken into account for the currently discussed amendment to the NFR. The paper also recommends that development activities promoting exotic foods must increasingly accommodate legitimate food safety concerns regarding neglected food species in project design and seek to generate data to enhance regulatory acceptance in target markets.

The authors argue that it is both possible and necessary to recast the current regulatory balance concerning access to PGRFA (on one end of the research/production/marketing chain) and the introduction of novel foods into commercial markets (at the other end of the chain) to advance the MDGs.

Introduction

The booklet distributed earlier to this conference, entitled 'Meeting the Millennium Development Goals with Agricultural Biodiversity', emphasizes the potential of biodiversity to contribute to: reducing the proportion of people living in poverty and hunger (MDG 1); reducing the mortality rate of children under five (MDG 4); reducing maternal mortality rates (MDG 5); and ensuring environmental sustainability (MDG 7).

In the present paper, the authors assess the degree to which the existing international legal framework promotes uses of genetic resources for food and agriculture (GRFA) that will assist in meeting those goals. In particular, the authors focus on recent developments in international law concerning a) access to, and exchanges of, GRFA; and b) regulations affecting the introduction of niche biodiversity products into commercial markets, with a special emphasis on the EU Novel Foods Regulation. In so doing, the authors attempt to strike a conceptual balance by examining a few of the international laws affecting people's ability to a) gain access to genetic resources as inputs into their systems of research, development and production; and b) move their finished products out to markets on the other end of the research and production chain. Of course, the authors are aware that there are a number of other important areas of law deserving equal attention in this context, such as intellectual property, bio-safety, and trade laws. However, time and page limitations do not allow the authors to address the latter areas in this paper. Other papers presented at the conference will provide an assessment of the contributions of some of these other areas of law to the realization of the MDGs.

The authors' general thesis is that, despite recent positive developments in some areas of law, the overall international legal framework still does not provide a secure and predictable basis for research, conservation, and use (including uses in production and marketing of new products) of GRFA that maximize the potential benefits for the poor. There are a few notable exceptions – for example, the International Treaty for Plant Genetic Resources for Food and Agriculture (International Treaty) which has

the potential to overcome a number of problems, but it is fair to say that international laws currently provide more challenges than opportunities. We make a number of recommendations concerning the reform of existing laws and the development of international agreements currently under negotiation, that would have the effect of better promoting the MDGs.

The authors also advance the position that some recent developments in international law are specifically designed to meet specific MDGs. For example, the Treaty is designed to contribute to the goal of world food security. The Convention on Biological Diversity (CBD) is more oriented towards the achievement of the goal of a sustainable environment. In seeking specific goals, initiatives in international law should take care not to inadvertently endanger the attainment of other MDGs. Other initiatives in international law, such as the regulation of novel foods, may inadvertently have a negative impact on the attainment of MDGs by acting as a non-tariff barrier to the introduction of poor peoples' products to lucrative markets.

Regulating access to GRFA and sharing the benefits derived from their uses

Crop research and improvement are at the heart of the ability of agriculture to meet the challenge of attaining food security. Crops can be improved to provide higher yield, contain a healthier micronutrient component, perform better in marginal environments, and resist disease - all of which can have a positive impact on hunger, malnutrition, poverty, and the sustainable use of the environment. Plant breeding and research depends upon sustained and sustainable access to a broad range of breeding materials, often collected from a number of different countries and continents. This is equally true for plant breeders, be they in national programmes, international research institutions, or in the private sector. Farmers in marginal environments purposefully deploy a genetically-diverse range of materials in their fields to ensure a relatively constant overall performance and stability of yield. Often, their systems of innovation and production depend upon a diversity of inputs, which they access through informal exchanges with other farmers, local markets, and government extension. Just as with formal sector breeders, the success of their innovation systems depends on ready access to a wide range of materials.

Plant genetic resources have always been freely exchanged among farmers at the local level. Farmers have always sought to increase the genetic diversity of their land races by exchanging seed with their neighbours or with farmers from further afield, as a means of maintaining stable productivity and increased protection against disease and other environmental challenges. But the exchange has not been limited to the local level. Throughout the ages, PGRFA have also been freely exchanged on a global level. Potatoes originated in Latin America and are now staple crops throughout the world. Wheat originated in the Near East, soybeans in East Asia. Secondary centers of diversity for these crops are now to be found in many parts of the world.

This historical movement of PGRFA across the globe has led to a situation of high dependence of all countries on plant genetic resources coming from outside their

borders and regions. When faced with new diseases. environmental challenges or simply the need to improve or broaden the genetic base of existing crops, countries have to look to the original centers of origin, or secondary or other centers of diversity, in order to seek disease-resistance or other traits they need. When famine struck the people of Ireland as a result of the potato blight in the 1830s, Irish farmers had to seek disease-resistant stock in Latin America before the European potato harvest could recover. When the taro leaf blight struck recently in Samoa, the country looked to Palau and the Philippines for new stock.

Evidence of the interdependence of farmers, countries, and continents on PGRFA can be seen at a variety of levels: data on exchanges of planting materials between farmers; data on international collections and distribution of samples of reproductive materials facilitated through international and (some of the larger) national genebanks (Fowler, et al., 2001; Halewood, et al., 2004; Fowler and Hodgkin, 2004); data on the mixed international ancestry of most of the crops that are grown by farmers around the world (Gollin,1998; Evenson and Gollin,1997); and data on the extremely high percentage of annual caloric consumption within all countries around the world coming from crops that originated in other countries. A recent FAO study put the degree of interdependency at an average of 70%, with no country or region being self-sufficient (Palacios, 2000).

Access to PGRFA and sharing the benefits derived from their use has been the subject of three different international instruments over the last 22 years. One of these, the International Undertaking on Plant Genetic Resources for Food and Agriculture (IU), was non-binding. The other two - the CBD and the Treaty - are binding international agreements. It is possible that a fourth binding agreement on access to genetic resources and benefit sharing within the framework of the CBD may be negotiated over the course of the next few years. A first meeting of an intergovernmental working group was held in February 2005, to look at the possibilities of developing such an agreement. It is important to understand the ways in which these instruments address and/or affect the needs of formal sector breeders and farmers, and the extent to which they can contribute to the MDGs and, in particular, those related to world food security and environmental sustainability. It is also important to understand the relationship among these instruments and the progression of ideas which led to their adoption. We will look first at the IU and then at the CBD, and finally at the Treaty.

The International Undertaking

The IU was adopted by the FAO Conference in November 1983. The adoption of the IU marked the conclusion of a period of active collection of plant germplasm sparked by reports of severe erosion of plant genetic resources important for food and agriculture as a result of the introduction of improved 'green revolution' technologies. The IU was a 'soft law,' meaning a non-legally binding instrument. Its objective, as set out Article 1, was "*to ensure that plant genetic resources of economic and/or social interest, particularly for agriculture, will be explored, preserved, evaluated and made available for plant breeding and scientific purposes*". Most importantly, the IU was

"*based on the universally accepted principle that plant genetic resources are a heritage of mankind and consequently should be made available without restriction*". While some 113 countries eventually declared that they would adhere to the principles set out in the IU, difficulties rapidly emerged from two quarters: from those who wanted to see a strong expression of state sovereignty over their plant genetic resources and from those who felt that the requirement that plant genetic resources - defined as including cultivated varieties, elite and current breeders' lines - be made freely available, somehow ran counter to plant breeders' rights, as expressed in the International Union for the Protection of New Varieties of Plants (UPOV) Convention. Both of these views tended to run against the idea of free availability, although from differing view-points. FAO tried to take these new ideas into account through a series of 'agreed interpretations' of the IU, adopted by the FAO Conference in 1989 and 1991.

The first two Agreed Interpretations dealt with Plant Breeders' Rights and Farmers' Rights. Under these interpretations, Plant Breeders' Rights, as provided for under the UPOV Convention, were recognized as being compatible with the IU. At the same time, the FAO Conference attempted to balance the recognition of those rights over formal innovations with recognition of the new concept of Farmers' Rights. Farmers' Rights were intended to be a recognition of the enormous contribution that farmers in all regions have made to the conservation and development of PGRFA, and a means of ensuring the conservation, management and use of those resources for the benefit of present and future generations of farmers. The third interpretation recognized that nations have sovereign rights over their plant genetic resources. At the same time, it provided that breeders' lines and farmers' breeding material should be available only at the discretion of the developers, during the period of their development.

It was within the framework of the IU, and the international network of *ex situ* collections provided for by the IU, that FAO entered into a series of agreements with the International Agricultural Research Centres of the Consultative Group on International Agricultural Research (CGIAR) in 1994, placing their collections under the auspices of FAO as part of that international network. The agreements recognized that the collections were to be held by the Centres 'in trust' for the benefit of the international community, and were to be made available without restriction.

The Convention on Biological Diversity

The concept of the sovereign rights of states over their genetic resources was at the very heart of the Convention on Biological Diversity (CBD), which was opened for signature at the Earth Summit in 1992. The CBD recognized that all States have sovereignty over their natural resources, and laid down the principle that the authority to determine access to genetic resources rests with the national government concerned and is to be implemented through national legislation. Access, where granted, is to be on mutually agreed terms and is subject to prior informed consent of the Contracting Party providing such resources. Similarly, benefit sharing, including the sharing of benefits arising from commercial and other utilization of

genetic resources, is also to be on terms mutually agreed with the Contracting Party providing the resources. For the purpose of access and benefit sharing, the CBD provides that 'genetic resources provided by a Contracting Party are only those that are provided by Contracting Parties that are countries of origin of such resources or by the Parties that acquired the genetic resources in accordance with the Convention' (CBD, 1993).

The paradigm case that the negotiators of the CBD seemed to have had in mind was that of genetic resources found in native forests that could provide the essential ingredients for new pharmaceutical discoveries, the key to their discovery being the traditional knowledge of the native inhabitants of those forests. In such cases, it was only fair that the state owners of the genetic resources and the local people with their traditional knowledge should share in the windfall profits of the pharmaceutical companies, who locked up those discoveries with new intellectual property rights. The CBD provided that States holding such resources should endeavour to facilitate access to them for others, but always subject to the concern that they should be in a position to negotiate a fair return for such access. The CBD itself provides for the conservation and sustainable utilization of all genetic resources, and not merely PGRFA.

The CBD itself did not provide that access and benefit sharing for genetic resources must be agreed on a bilateral basis. Indeed, as the authors will point out in the following section, the provisions of the CBD, and its three main principles - national sovereignty, and access on mutually agreed terms and subject to prior informed consent - are equally supportive of, and consistent with, the creation of a multilateral system of access and benefit sharing, such as that established by the Treaty. In practice, however, the tendency has been to implement access and benefit sharing mainly at the bilateral level, by means of negotiated agreements between the state of origin (and constituents within it) and the state or company seeking access. The authors take the position that a bilaterally-oriented approach to regulating access and benefit sharing of PGRFA does not build upon or reflect the international interdependence on PGRFA, the historic patterns of reliance and use by plant breeders at all levels (informal sector, public national, public international and private sector) and the historic systems of innovation and use by farmers in marginal farming areas. And this position appears to be supported by a growing body of anecdotal evidence that there has been a significant reduction in exchanges of PGRFA between countries in recent years.

The tendency of the Parties to the CBD to implement its access and benefit sharing provisions on a primarily bilateral basis has been reinforced by a number of actions of the Conferences of the Parties (CoP) to the CBD. For example, in 2001, CoP 6 adopted the Bonn Guidelines (CoP 2002)which provide guidance for countries on how to establish national bilaterally-oriented access regulations. More recently, in February 2005, the CBD's Ad Hoc Open Ended Working Group on Access and Benefit Sharing met to start negotiations for what could turn out to be an additional internationally binding instrument, within the framework of the CBD, on access and benefit sharing. While it is still very early in the process, it is important to note that

the text developed at that first negotiating meeting stresses elements and principles which, once again, are bilateral in nature. The authors are sympathetic with countries that feel that their national genetic resources are being exploited by others. However, they are also concerned that the paradigm based on regulating access to wild plants and animals, and traditional knowledge, may eclipse appreciation of the advantages of considering alternative approaches to regulating access and benefit sharing of PGRFA that would allow people to make use of them in ways that contribute more directly to the realization of the MDGs.

The International Treaty on Plant Genetic Resources for Food and Agriculture

The multilateral system of access and benefit sharing established by the Treaty is based on appreciation of the fact that PGRFA are very different from the paradigm case mentioned above. In particular, it is based on appreciation of the fact that all countries are interdependent upon PGRFA and that they are vital to food security.

After seven years of intensive negotiations, the Treaty was finally adopted by the FAO Conference in November 2001. The Treaty provides for a Multilateral System of access and benefit sharing for a list of 34 crops and 29 genera of forages. The criterion for selection of the listed crops and forages is i) global interdependence and ii) importance to food security. The Multilateral System is further restricted to those PGRFA that are in the public domain and are under the management and control of a Contracting Party. For these crops, the Parties to the Treaty have agreed to accord facilitated access on the basis of standard terms that have been agreed multilaterally, and in accordance with a standard Material Transfer Agreement to be drawn up by the Governing Body of the Treaty. The Multilateral System also provides for benefit sharing on a multilateral basis, including payment into an international mechanism of an equitable share of benefits arising from the commercialization of products that incorporate material accessed from the Multilateral System. Such payments are to be mandatory if the recipient restricts further access to the product, for the purpose of research, breeding or training.

The Treaty is fully consistent with the CBD. PGRFA are subject to national sovereignty, and the access and benefit sharing mechanism established by the Treaty is based on the principles of mutual agreement and prior informed consent. While the Multilateral System of Access and Benefit sharing is at its heart, the Treaty provides a general framework for the conservation and sustainable utilization of all PGRFA, not limited to those covered by the Multilateral System. The Treaty also provides for a funding strategy to allow for its implementation and for the role of the Governing Body in further developing the Treaty and overseeing its implementation.

The Treaty entered into force on 29 June 2004, and as of 2005 has some 65 State Parties.

The Treaty will help to resolve one of the most pressing problems confronting food and agriculture, namely the continued flow and exchange of plant genetic

resources most important for food and agriculture. To rely on the negotiation of a network of bilateral arrangements for such PGRFA would be time-consuming and unnecessarily expensive in transaction costs. The Multilateral System and its reliance on standard globally-agreed terms makes those costs avoidable.

However, the list of plant genetic resources for food and agriculture covered by the Multilateral System does not cover all the plant genetic resources to which countries will need to have access. One example of PGRFA not yet covered is the PGRFA of under-utilized crops, such as African leafy vegetables. Local people in Kenya rely upon over 200 species of leafy vegetables to supplement their diets - plants that are rich in micronutrients. Since these crops are not included on the Annex 1 list, the Treaty does not guarantee that PGRFA of these crops will be exchanged on a multilateral basis between state parties for the purposes of research and conservation. This is particularly important when one considers the potential importance of these highly nutritious plants as supplements to the diets of people in other countries who are not currently consuming them. One needs only to consider the hypothetical predicament of a national crop research office that decides, in the light of recent evidence of the nutritional benefits of local leafy vegetables, to build up a national leafy vegetable program. Because such crops are not included in Annex 1 of the Treaty, the office would have to approach each country on a sample by sample basis to negotiate terms and conditions for transfer. Given the currently highly charged political atmosphere, this would indeed be a daunting (if not impossible) task.

It is important to note that the Treaty does not in any way prohibit parties from making non-Annex 1 materials available on terms and conditions identical to those of the Treaty's multilateral system. However, the fact that a crop is not on the list will make it unlikely for countries to automatically provide it on the same conditions, at least in the shorter term.

As noted above, the Treaty adopts what is basically a multilateral approach to the most important plant genetic resources for food and agriculture, recognizing that their continued exchange will be critical for the future food security of the world, one of the most important of the MDGs. One of the challenges facing countries will be to determine to what extent their national interests may lie in fostering the exchange of such PGRFA that are not included in Annex 1. Evidence of past patterns of exchanges of non-Annex 1 crops show that, in the short run, countries may wish to organize regional multilateral systems of exchange.

Another challenge will be to ensure that negotiations in other fora, such as the discussions on a legally binding agreement under the CBD on access and benefit sharing for genetic resources in general, do not have a negative impact on attempts to achieve the most important of the MDGs, namely world food security and reducing the number of the world's hungry and malnourished. In particular, care should be taken to avoid closing off the possibilities for countries to continue to allow for facilitated exchange of PGRFA in their own interest, whether such exchanges may take place under an expanded list of crops contained in Annex 1 of the Treaty or under other arrangements. In approaching these negotiations, countries will need to take

into consideration the special nature of those resources and global/regional reliance upon them for food security, poverty alleviation, and nutrition. Each country will also need to assess for itself where its national interests may lie, whether in PGRFA or in other forms of genetic resources.

Recommendations

Ratify and implement the International Treaty

The authors recommend that countries that have not yet ratified the Treaty should do so, preferably before the first meeting of the Governing Body (probably in March 2006) to be able to participate in its decision-making processes. Countries should participate in upcoming meetings concerning the development of the standard MTA for use in the Treaty's multilateral systems, in the spirit of cooperation, recognizing that the biggest single benefit to be gained through the Treaty is the 'multiplier effect' of access to exponentially increased accessions of PGRFA, by making their own Annex 1 material available. Parties should attempt not to get bogged down in highly politicized struggles over the details of the financial benefit-sharing provisions.

Allow 'room' for multilateral approaches to the regulation of access and benefit sharing for non-Annex 1 crops, and possibly all GRFA

In light of the above, the authors recommend that state parties engaged in the negotiations of an international regime (or regimes) on access and benefit sharing within the framework of the CBD should be careful not to lump PGRFA and other forms of GRFA into the regime they develop, without taking into consideration the special nature of those resources and global reliance upon them for food security, poverty alleviation, nutrition, and so on. At the very least, the negotiators should leave room for state parties to develop multilateral approaches to access and benefit sharing for important PGRFA that are not already included in Annex 1 of the Treaty. One such approach could be the development of regionally-based agreements for exchange of important materials for research, breeding and or/direct use. Another approach would be to expand the list of Annex 1 crops itself.

Regulating market access of biodiversity products derived from GRFA

In the second part, we focused on developments in international law concerning the regulation of access to GRFA as an input into research and development, and production systems - an area that has been the subject of a great deal of attention in recent years. This is an area in which special attention has been paid to the need to achieve specific MDGs. We will now focus on the regulation of access to markets for what we will refer to as 'biodiversity products', in which the guiding role of the MDGs has not played a significant role. This is potentially a very important area of regulation because it affects the ability of poor people to respond to opportunities

afforded by the increasing demand for specialty products, and to generate income directly from the production and marketing of local biodiversity products. This is an area of law and policy that has, in general, received considerably less attention in the media and generated less open public debate than access and benefit sharing. In this paper, we will focus on how food safety regulations have had a tendency to constrain the ability of developing countries to capitalize on their rich biological heritage by limiting opportunities to market biodiversity products both at home and abroad.

Food safety regulations – an emerging non-tariff barrier for biodiversity products

Owing to the growing demand in rich countries for 'exotic' foods and ingredients, biodiversity-derived products from developing countries provide many – but largely unrealized - opportunities for income generation of the poor, in addition to domestic markets. Edible plants, especially the less common species grown by poor farmers on a minor scale (which, for lack of a better term, we will refer to as neglected and under-utilised species or NUS) abound in the tropics and offer novel tastes and particular attributes for product diversification and innovation in upscale markets. Affluent consumers are motivated by their desire for dietary diversification and their unease regarding industrial production methods. Marketable attributes of NUS include nutritional and culinary excellence, distinct health-promoting properties (high contents of vitamins or functional nutrients, non-allergenic properties, etc.) and aesthetic appeal. Further contributing to their consumer appeal is the fact that often these products are derived from environmentally-sustainable and ethically-managed production systems (organic agriculture, small farmers). A growing number of companies embrace fair trade principles and build supply chains back to poor farmers, who benefit in terms of contract farming, higher prices and/or purchase guarantees.

In recognition of this development, many donors and national authorities are committed to trade promotion. The United Nations Conference on Trade and Development (UNCTAD) has launched the BIOTRADE Initiative, which seeks to stimulate trade and investment in biological resources to promote sustainable development, biodiversity conservation and poverty alleviation. Through its regional programmes linking several Andean and Amazonian countries, the BIOTRADE initiative supports the establishment of an appropriate institutional framework to develop biodiversity product and service markets, under sustainable principles. The specific aims of BIOTRADE include 1) providing a space for investors to obtain information regarding biodiversity products and services offered; 2) developing trade-promoting technical capacities; 3) the organization of promotional events and product fairs; and, 4) specific capacity building activities for value-adding and small enterprise development. National and donor-funded organizations such as GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) (through Private Public Partnerships and other programs), SIPPO (Swiss Import Promotion Program) and CPI (Centre for the Promotion of Imports from Developing Countries, Netherlands) support the BIOTRADE framework.

At the same time, food scandals and misleading product information in the food trade have made consumers in target markets wary of their foods. Lawmakers in developed countries have responded with a growing tide of new legislation that regulates the testing, market admission and labeling of food. This is consistent with recommendations of the WHO-FAO convened *Codex Alimentarius*, an internationally approved framework of standards dedicated to food safety and fair competition.

Lawmakers have paid particular attention to the safety assessment of food made from genetically modified organisms (GMOs). There has been a tendency within the same regulatory frameworks to extend the safety assessment strategies for GMO foods to other kinds of novel foods, such as those derived from novel processes or for which there is no history of consumption in the country or region concerned. In this section, we will be focussing on the impact of novel food regulations on the myriad of traditional foods that may have been consumed for years in a particular area of the world, but which have not been exported to other places, particularly in developed countries that provide potentially lucrative markets. (We refer to these foods as traditional exotic foods.) Many of these traditional foods are generally regarded as safe in the countries where they have been consumed for a long time, yet little if any formal scientific information is available on their composition and safety.

Today, a number of countries, including Canada, Australia, New Zealand, and Switzerland, as well as the EU, have regulations for novel foods that include traditional exotic foods. The definition of what constitutes a novel food as well as mandated safety assessment procedures vary but, in general, regulations require safety assessments to be conducted before a food can be placed on the market.

We will focus now on the European Novel Food Regulation (NFR, Regulation No 258/97), a directive that requires particularly stringent food safety assessments of traditional foods (viewed as novel from a European perspective) for pre-market approval. The NFR has been in force since 1997. The NFR arbitrarily defines novel food as food or food ingredients that were not used for human consumption to a significant degree within the EU before 15 May 1997. It would seem that this concerns the majority of exotic traditional foods which have begun, only recently, to make their way into foreign markets.

The NFR requires that anyone wishing to place a food product on the EU market must state whether the food is novel and present evidence to support that statement. If the food *is not* novel, it may be placed on the market and its assessment under the NFR is not required. If the food *is* novel, an assessment of the food's safety under the NFR is required in order to obtain permission to place the food on the market. Once submitted to the relevant member state authority, the application procedure allows for all member states of the European Commission, and relevant advisory bodies, to intervene at various stages. The applicant is required to present scientific documentation with regard to food composition, recorded and suggested intake levels, toxicological and allergenic data. Unfortunately, scientific documentation of the innocuousness of many traditional exotic foods, even if they have a long

history of safe use, is typically non-existent or deemed insufficient by regulators. The knowledge of local peoples from the exporting country, which often supports food uses and product attributes (generally referred to as 'indigenous knowledge' – IK) is not recognized as evidence in the evaluation of novel product applications. The average time lapse from the acceptance of an application to the final decision is 18-24 months.

In the eight years that Regulation EU 258/97 has been in place, several applications for exotic traditional foods have been declined or challenged, on the grounds of insufficient food safety documentation. Examples include the natural sweetener *Stevia rebaudiana*, nangai nuts from a Pacific genus of trees (*Canarium spp*), and the Andean root maca (*Lepidium meyenii*).

As of today, only one traditional exotic food product has been authorized as a novel food: the juice of the noni fruit (*Morinda citrifolia*), produced by a large US-based company. Noni is widely used in Polynesia as a traditional food and folk medicine. In the initial assessment, the company's application was rejected, based on a series of specific objections. Only after the company had produced extensive food safety evidence from compositional, toxicological and allergenicity studies and clarified suggested intake level, did the EU grant authorization in June 2003.

It is important to note that an authorization pursuant to EU 258/97 is limited to a particular product. The placing on the market of any other noni products - for example, jam, the spray-dried juice, or the dried whole fruit - requires a separate authorization. Not only is the authorization specific to a particular product, it is also granted to particular applicants. Subsequent applicants can market the same or similar products only upon providing evidence that the product is substantially equivalent to the product already allowed.

The practices of approving specific products associated with supply by specific applicants has the effect, at least temporarily, of granting the first successful applicant a unique market position as the sole supplier of, for example, noni juice on the EU market. This aspect of EU 258/97 has infuriated a host of smaller companies that cannot afford the needed research to seek authorization for their own noni products.

Past declined applications and currently challenged applications pursuant to the NFR have been, and are being, widely observed by potential exporters/ importers, raw material traders and distributors of specialty foods. The costs, complexity, length, and uncertain outcomes of NFR procedures have led to legal uncertainty and discouraged firms in the sector to file applications.

No matter how favorably candidate novel foods are viewed in relation to market potential, companies shy away from the investment and time-demanding efforts of registering them properly through the NFR. Chances of EU market admission for the majority of exotic food species are currently very low unless the extensive data necessary to meet the food safety assessment criteria are available. Larger corporations have research budgets to tackle this task, but rarely justify such expenses in view of the still embryonic market size.

On the other hand, the NFR curtails the entrepreneurial initiative of small and medium-sized companies, who typically have the agility and pioneering spirit to develop niche products but cannot afford the research to gain regulatory acceptance.

In conclusion, the NFR has emerged as a serious, albeit unintended, non-tariff trade barrier to imports from the developing world into the EU, perhaps the most attractive market for exotic traditional foods. Thus, foods that could add variety to diets and that have a long use tradition in the countries of origin, are denied access to EU markets. Both developing-country farmers and European consumers are losing out.

A public sector alliance including IPGRI, GFU (Global Facilitation Unit for Underutilized Species), GTZ, the PhAction Consortium, and UNCTAD's BIOTRADE Initiative, is currently lobbying EU policy makers to accommodate developing country concerns in the amendment of the Regulation due in 2005. The alliance recognizes the need for consumer protection in the EU, but it urges EU lawmakers to acknowledge the special nature of exotic traditional foods and the need for their continued commercial use for biodiversity conservation and poverty alleviation through trade. Specifically, the alliance makes the recommendations set out in the following section.

Recommendations

Recognize exotic traditional foods as a separate Novel Food Category

There is only cursory mention in the NFR and in related EU discussion papers of exotic traditional foods, as if they were almost immaterial to the regulation. Traditional foods consist of a vast variety of food items and are of growing importance to poor country economies and to the diet diversification desired by EU consumers. In light of the diverse nature of novel foods it is unreasonable to subject them all to a single safety assessment as currently practiced under the NFR, which is primarily geared to address challenges associated with genetic modification. Different criteria and evidence requirements may need to be applied to different sub-groups of exotic traditional foods.

Simplify the safety evaluation of exotic traditional foods

The stringent food safety assessments required by the NFR place an unreasonably high burden of proof on those bringing traditional food products from the South to the EU market. Instead of requiring the scientific demonstration of the food safety of traditional foods, the concept of "qualified presumption of safety" based on evidence of long-term consumption might be a more reasonable approach. This could be combined with post-marketing product surveillance. Applicants should be required to present extensive data with regard to composition, nutritional composition/content, intake levels, toxicology and allergenic potential only where there is no evidence of long-term consumption in other countries and concrete doubts are raised as to the safety of a product.

In addition to experimental scientific evidence, the NFR should admit traditional knowledge for food safety assessment. The combined evidence on a particular food from the ethno-botanical and anthropological literature as well as from anecdotal and folkloric sources can provide important pointers for safety assessment.

Approval should be general, for any potential importers of an approved/ registered traditional exotic food product

Under the current NFR, if a novel food is authorized, only the applicant is allowed to place the product on the EU market. Addressing decisions to a particular applicant makes sense for a novel food that is the result of an innovative process or based on a proprietary technology, which the process of the NFR protects. But in the case of exotic traditional products, which are of public domain outside the EU, this procedure is prone to create monopolies and allows firms to appropriate public sector goods. In this process, the IK associated with products is 'appropriated', as it were, by its being scientifically substantiated.

This paper therefore supports the idea of making 'regulations with general application' in response to applications under the NFR. This alternative would have the advantage of binding all relevant parties to follow applicable requirements in relation to a particular exotic traditional food. Multiple applications for products would not need to be made and processed, and greater efficiency would be achieved.

From a development perspective, it would be desirable if non-profit or public sector institutions with no intent to place the product on the market themselves, could make an application. For example, a government, regional organization or donor might want to invest in a particular product or food species and assume the cost for opening up the EU market to target beneficiaries (such as poor farmers producing and exporting the product).

Approval should be for a wider range of products derived from an exotic traditional food

Wherever possible, market admission should be granted for a host of products obtained from the traditionally used plant parts, especially for products obtained through traditional or conventional processes. For example, if an application for a particular fruit were to be filed, the NFR should allow a single safety assessment for pasteurized juice, frozen pulp, jam, ice cream and related products.

Conclusions

National policy makers often overestimate the financial value of the PGRFA within their borders. This fact, combined with historical political tensions rooted in colonialism and north-south inequalities, has naturally led to a situation where policy makers' first inclination is to strictly control access to their countries' genetic resources. Regulatory frameworks that feature case-by-case applications and negotiations of terms and conditions may be appropriate for wild and/or endemic

species of flora and fauna; they may lead to situations where countries and their constituent communities eventually enjoy substantial benefits derived from others' use of their genetic resources. However, it is the authors' contention that this approach to regulating access is much less appropriate for PGRFA; in fact, it can create obstacles to people being able to enjoy the greater cumulative benefits that can be created through widespread use of those same resources. The world community is in the process of striking a balance between these competing objectives and regulatory frameworks, so raising the general level of awareness about the value of PGRFA is now more important than ever.

Food safety concerns with regard to traditional foods will not disappear. The authors welcome the fact that nutritional, compositional and other food safety documentation will continue to be required to ensure market access of biodiversity products. Once again, however, there is a need to make sure that the world community strikes the correct balance between its competing policy goals, and ensures that those that are most closely related to the MDGs are ascendant. To this end, there is a need for proactive engagement to ensure that novel food regulations do not end up preventing poor people from gaining access to potentially lucrative markets for their foods. Greater awareness needs to be promoted in developing countries regarding the implications of food safety legislation in target markets for biodiversity products.

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Abbreviations and Acronyms

CBD	Convention on Biological Diversity
CGIAR	Consultative Group on International Agricultural Research
COP	Conferences of the Parties (to the Convention on Biological Diversity)
CPI	Centre for the Promotion of Imports from Developing Countries
FAO	Food and Agriculture Organization of the United Nations
GMO	Genetically modified organisms
GRFA	Genetic resources for food and agriculture
GTZ	German Cooperation
IARC	International Agricultural Research Centres
IK	Indigenous Knowledge
IU	International Undertaking
MDG	Millennium Development Goal (s)
NFR	Novel Food Regulation
NUS	Neglected or Under-utilized Species
PGRFA	Plant Genetic Resources for Food and Agriculture
SIPPO	Swiss Import Promotion Program
UNCTAD	United Nations Conference on Trade and Development
UPOV	International Union for the Protection of New Varieties of Plants

Marketing biodiversity and benefit-sharing: a product development perspective

by N.P. Louwaars and B. Visser[1]

Abstract

Genetic resources are of prime importance for humankind. They may represent an immediate value, in terms of the contribution of genetic diversity both to the identity of communities (cultural value), and to the sustainability and stability of primary production (production value).

In addition, genetic resources can represent a market value, especially when the products immediately derived from diverse materials fetch a higher price than conventional (bulk) products.

Finally, they represent an option value and can be considered an insurance against future problems.

The Convention on Biological Diversity (CBD) provides nations with sovereign rights over biodiversity in its provisions on granting access subject to certain conditions and in its opportunity to conclude benefit-sharing agreements. At the same time, nations have responsibilities for the conservation of genetic resources and for promoting their sustainable use.

Key in the debate on genetic resources is to render conservation and management strategies sustainable (meaning to contribute to the long-term option value), to have them contribute to sustainable development (production and market value) and to allow genetic resources to continue to contribute to the cultural identity of communities.

International agreements, such as the CBD and the IT-PGRFA, mean to contribute to conservation and sustainable use, and are primarily based on the concept of option value of genetic resources, and the creation of values normally outside the reach of provider countries and communities. However, neither monetary nor non-monetary benefit-sharing provides a guarantee for conservation. The production and particularly the market value of genetic resources appear to be potentially much stronger drivers for conservation while immediately contributing to sustainable development. Private rights provided by intellectual property systems are better linked to market approaches than the public rights provided by agreements on genetic resources. However, conventional IPRs, such as patents and breeders' rights,

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do not seem to support diversity-based marketing approaches. Based on experience with the marketing of diversity-based products, we have studied the opportunities to use other IPR systems to create greater market value for genetic resources and to arrange for a sharing of benefits by the farmers and communities that developed and maintain such diversity.

Trademarks and Geographic Indications may not offer straightforward solutions, but deserve to be investigated better, potentially using benefit-sharing arrangements, in agreement with the CBD, to cover initial costs. More importantly, such systems seem to fit better into farmers' century-old practices based on sharing and recognition.

Introduction – values of biodiversity

When developing markets for food products, one has to determine their potential value. Biodiversity and, in particular, genetic resources have four types of value: option value, production (or use) value, market value, and cultural value.

Option value is the future value of biodiversity that is currently still unknown. The establishment of genebanks is built on the perception that genetic erosion carries the risk of reducing future options for genetic improvement of crops using yet unspecified alleles and gene combinations. Neither the benefits of conservation nor the likely distribution of benefits across the global community are known. Even though local community genebanks can contribute to long-term conservation, the primary responsibility for long-term conservation lies with national governments, in addition to the task of the International Agricultural Research Centres (IARCs), which maintain collections in trust under an agreement with the Food and Agriculture Organization of the United Nations (FAO).

A major complication regarding conservation efforts based on the option value is that these carry a cost without providing immediate benefits, and that it, nevertheless, requires sustainable funding of the conservation and documentation programmes.

Production value is the immediate value of genetic resources for farming, which is comparable to the value of natural biodiversity for tourism. The production value is embedded in the seed and in the case of modern uniform varieties this value can be protected in many countries. The value of diversity is particularly visible for farmers in ecologically diverse conditions, where genetic diversity provides an important contribution to yield security. Planting genetically diverse crops can protect farmers from total crop failures, and planting different crops may increase resource-use efficiency and render farmers less dependent on market failures (Altieri, 1995). Such farmers contribute to conservation by using and managing diversity on-farm (Brush, 2000). However, the introduction of modern farming practices such as fertilizers and pesticides reduces ecological diversity, and scientific breeding produces more and better uniform varieties and reduces genetic diversity. Both trends explain how diverse landraces are losing their comparative advantages to introduced varieties, thus reducing opportunities for on-farm conservation. A major strategy to counter this trend is to upgrade genetically diverse varieties by introducing exotic genes

through participatory plant breeding and by improving farmers' capacities for breeding and selection themselves. However important, the number of successes of such types of participatory plant breeding is still limited, especially as their up-scaling and mainstreaming prove difficult, and sustainability depends on the farmers' own capacities to improve their crops, and the continued availability of valuable sources of new alleles for such improvement.

Market value of biodiversity is the commercial value embedded in the product. It can be described as the additional value of diversity-based products compared to regular products. Examples are a mark-up price for red-seeded paddy in several countries in Southeast Asia, the marketing of baskets of mixtures of local potatoes in the cities of Peru, and the niche-markets of ecologically produced vegetables in Europe that are often based on old regional varieties. The development of such markets often requires sound marketing approaches, including placing existing traditional products, either fresh or processed, in new (often urban) markets. Such markets provide a potentially sustainable basis for cultivating diversity, assuming that the benefits can be shared equitably between retailers, traders and farmers.

Cultural value of biodiversity may be linked to religions or traditions (sacred trees or animals) and to the link between the sources of life (livestock and crops) and the cultural identity of communities. For example, such a link is very strong with pastoralists whose cultural identity may be linked to the shape and size of the horns of their cattle (such as the Ankole tribe in Uganda), but it is also strong in indigenous farming communities in Latin America (for example, maize-dependent farmers in Central America). This type of value can be very high but it is by definition confined to the community itself and has not been commoditized. It cannot be 'marketed' to other communities or consumers and create additional monetary or non-monetary value.

Genetic resources exhibit a cultural value, a production value, and an option value. In addition, they exhibit a market value, but this value represents an under-researched field.

This paper analyses current regulatory mechanisms to promote sustainable management of genetic resources in agriculture in the light of these different values. These mechanisms include international agreements that provide obligations to develop national regulatory frameworks for the management of genetic resources.

Creating value at the international level through benefit-sharing

Conservation of biodiversity has been on the scientific agenda since the development of genetic diversity concepts and collection efforts by Vavilov, the political aspirations for autonomy of several nations in the first half of the 20th century, and the establishment of international genebanks during the Green Revolution. It became a political issue in the period leading to the International Undertaking on Plant genetic Resources for Food and Agriculture in 1983, and in particular the Convention on Biological Diversity, ten years later. The Convention defined biodiversity as a natural resource under national sovereignty and placed a responsibility for conservation on the national states. States

may set conditions to access, particularly through the requirements for Prior Informed Consent and for Benefit-Sharing, while having the obligation to conserve genetic resources and promote their sustainable use. The CBD allows for bilateral exchanges of genetic resources between a provider-country and a user.

In 2004, the International Treaty on Genetic Resources for Food and Agriculture made provision for a Multilateral System for Access and Benefit-Sharing.

In a parallel process, intellectual property was the issue of an international trade agreement (WTO-TRIPS), promoting the global spread of intellectual property protection regimes including those affecting plants and plant varieties. Many more countries than the signatories of earlier conventions and treaties, such as those concluded in Paris (on patents, 1883), Berne (copyright, 1886), Madrid (trademarks, 1891), Paris (1961, plant varieties), Lisbon (1971 on appellation of origin) and Budapest (micro-organisms, 1977) have now been forced to introduce legislation on intellectual property protection. Where the CBD and IT confer rights to public organizations such as national governments, intellectual property systems basically provide private rights.

Legislation for administering and enforcing these private rights has been in place in industrialized countries for many years and new entrants to the system have straightforward examples to follow or to adapt. In contrast, the implementation of public rights and responsibilities as following from the CBD and IT is still subject to debate and experimentation.

A substantial number of countries have established some form of access and benefit-sharing regulations. In most of these regulations, it is unclear how benefits are to be shared with the communities that provide and maintain the resources. The link is clearer in non-monetary benefit-sharing arrangements since these necessarily include a specification of the recipients of the benefits. However, such arrangements are found in the legislation of only seven countries.

The Supreme Decree No. 24676: Art. 40a-d of Bolivia, and Provisional Measure No. 2.186-16: Art. 25 of Brazil mention 'technology access and transfer', 'unrestricted licensing' and 'training of human resources'. Decree No. 31514-MINAE (Art. 6m) of Costa Rica and the Biodiversity and Community Knowledge Act (Art 13, 14, 16) of Bangladesh include economic, environmental, scientific-technological, social or cultural benefits as options.

Most specific is the Executive Order No.247 (Section 5) of The Philippines, demanding collectors to sign either an Academic Research Agreement or a Commercial Research Agreement. As such, the Philippine legislation well exceeds the average national ABS regulation in providing for highly detailed NMBS clauses (Sections 5h,i,l). However, the Philippine government is redesigning administrative and other elements of the regulation to ensure it does not act as a disincentive to research (Laird, 2001). Other countries that have included non-monetary benefit sharing are India (The Biological Diversity Act: Art 21:2b-f), and Argentina (Law on Access to Genetic Resources: Art. 18).

Some notable examples of benefit sharing illustrate the search for effective instruments. Institutional framework agreements include the following:

(a) Companies that test plant extracts from the University of Peradeniya (Sri Lanka) agree to grant the University a fellowship for a period of three years, valued at US$ 15,000.
(http://www.wipo.int/tk/en/databases/contracts/texts/html/universitysl.html#nonmonetary)

(b) The "research agreement on the discovery of (unspecified) natural products from micro-organisms between Syngenta Crop Protection AG (Basel, Switzerland) and the HUBEI Academy of Agricultural Science (Wuhan, China)" stipulates that the user should care for "intellectual property-related training, technology transfer, exchange of results, funding of strain collections, fermentation and pre-screening activities in China."
(http://www.wipo.int/tk/en/databases/contracts/summaries/syngenta.html)

(c) The ABS Agreement between the Lebanese Agricultural Research Institute (LARI, Lebanon) and the Kew Royal Botanic Gardens (United Kingdom) contains detailed NMBS clauses, including "acknowledgement of LARI as source of the material in research publications, joint authorship of the publications, copies of research results, and encouragement of study and training and/or study of both LARI and Kew personnel".
(http://www.wipo.int/tk/en/databases/contracts/summaries/larikew.html)

The limited number of cases on agricultural use contrasts with the relatively larger number regarding the pharmaceutical sector.

Transaction-specific agreements in the agricultural sector tend to be more detailed:

(a) In 1997 an agreement was concluded between UC Davis (USA), the University of Mali and the Bela community (Mali) on access to and benefits from the wild rice gene *Xa21* (derived from *O. longistaminata*). A special Genetic Resources Recognition Fund was founded to finance fellowships (at UC Davis) for students from source countries, giving priority to Mali. The agreement specifies that farmers in developing countries will be able to acquire seeds of UC Davis' transgenic lines at the same cost as traditional parental lines (Ten Kate and Collins, 1998).

(b) The Memorandum of Understanding (1998) between USDA, the Paraguayan National University of Asunción, the Ministry of Agriculture and Livestock, the Instituto Agronómico Nacional (IAN), and IPGRI describes the terms under which the USDA can access Chile pepper *(Capsicum)* germplasm in Paraguay. The source country is offered a security backup of the collection in Paraguay at the USDA National Storage Laboratory, training to IAN scientists, an inventory of wild crop relatives native to Paraguay, and an analysis of *in situ* preservation of *Capsicum* (Williams, 1998).

The challenge of benefit-sharing agreements based on international agreements is to secure a sustainable flow of benefits that can contribute to the conservation of genetic resources at the local level.

Analysis of a large number of cases reveals that they concentrate almost exclusively on providing benefits to the immediate provider (often a research institution) and not to communities, and that their contribution to on-farm genetic

resource-management can be considered minimal. Secondly, most of these benefit-sharing agreements are time-bound and therefore cannot be considered to provide a sustainable stimulus for conservation. The use of a genetic resource abroad may even remove the stimulus to conserve it locally since a contract with a specific user may in some cases reduce the interest of potential other users in the same resource - for example, when (derivatives of) the resource will be patented.

International agreements create a new type of value for genetic resources. Normally, such benefit-sharing agreements do not directly include local communities and rarely represent sustainable contributions to conservation. Since bilateral negotiations depend on negotiation capacity and knowledge of potential use and value, capacity building is of prime importance to reach agreements that share benefits equitably.

According to the analysis of Seiler and Dutfield (2002), Artuso (2002), and Caillaux and Ruiz (2002), the challenges confronting developing countries in order to benefit from the utilization of the genetic resources can be summed up as the need to:

- perform a comprehensive market and demand analysis for genetic resources at the national level
- identify the technology field or industrial and market segments in which they are competitive, and acquire and/or focus the material and human capital required to develop high quality products
- develop arrangements ensuring that the utilization of genetic resources supports rather than impairs the conservation of biological diversity
- develop a critical mass of properly trained scientists and technicians.

The limitations in industrial development in many biodiversity-rich countries, coupled with the limited insight on the value of certain genetic resources as the result of a limited human capacity, illustrate the difficult tasks that negotiators face in obtaining a fair and equitable deal. It illustrates even more clearly the problems that communities encounter when they have to give their prior informed consent on use, the full extent of which they commonly cannot see. Finally, the sustainability of benefit-sharing efforts determines the longer-term impact on the conservation and use of genetic resources as well as on national or communal development.

Creating value at the local level through markets

Sustainability of diversity on-farm can only be achieved when the resources concerned represent a value at the local level.

The production value of genetic resources is important for every farmer. Adapted varieties provide the best basis for high and sustainable output. However, more and more farmers depend for their varieties on outside sources, both in formal and local seed systems. This increased dependence can be explained by continuing research at national and international research institutions and companies, and by an increased market orientation of farmers, who have increasingly acquired opportunities to buy inputs such as seeds and fertilizers.

The production value of diversity is high in ecologically diverse environments, such as environments with erratic rainfall patterns, diverse soil fertility levels, etc. Diversity also provides opportunities to cope with changing needs based on climate change or gradual land degradation. In situations where ecological diversity is reduced, for example through the use of fertilizers and pesticides, the production value of diverse crop varieties has decreased equally. In such conditions, farmers need varieties that optimally respond to these inputs and provide a high return on investment. These farming practices often produce such benefits most effectively in monoculture and on a larger production scale, thus leading to specialization, further market orientation and a reduction of diversity at the farming system level.

However, most changes occur gradually. Strategies to conserve and manage genetic resources could thus help in having diverse varieties adapt to changing conditions and in preventing developments by which new, better-performing varieties replace farmers' varieties. Various reports highlight the capability of farmers to introduce new alleles into their crops by planting introduced or off-type plants in or next to their fields, assuming that some introgression will occur (Louette, 1999; Salazar et al., 2005).

Building on this practice, and giving it more direction and focus, participatory plant breeding strategies combine local and scientific knowledge and also combine local and introduced materials (Virchow, 2002). Such efforts thus increase the production value of the local varieties and prevent the introduction of exotic varieties replacing the local ones. This strategy thus contributes to the management and conservation of genetic resources on-farm. Participatory plant breeding programmes range from on-farm testing of a range of materials to full blown farmer-breeding such as the rice breeding programme of the island-farmers of Bohol, Philippines (Searice, 2001).

An advantage of these on-farm management strategies compared to *ex situ* conservation is that natural selection in combination with farmers' selection will generate new diversity rather than 'freezing' the available diversity in genebanks. The main advantage of *ex situ* collections is that the diversity can be better described and documented, rendering it more readily available for use.

The on-farm management approaches based on participatory plant breeding described above are different from on-farm conservation efforts where farmers are stimulated to maintain traditional varieties through subsidies that compensate for the loss of production value compared to other uniform production options. In on-farm management there is no guarantee that alleles remain in the population. Whereas exploiting participatory plant breeding might lead to a loss of certain diversity, options by which farmers maintain landraces based on subsidies also imply that the drive to properly select the varieties will disappear, leading also to genetic drift in the populations concerned. At the same time, increasing the production value of farmers' varieties seems financially more sustainable than subsidies.

Another approach is the creation or increase of diversity-based market value. This yet under-researched strategy can be exploited at the species level as promoted by the Global Facilitation Unit for Underutilized Species (http://www.underutilized-species.org) and at the sub-species level. Strategies may be similar, i.e. creating a market for diversity-rich products such as traditional vegetables or local varieties with specific characteristics.

The Community Biodiversity Conservation and Development Programme, a network of mainly non-governmental organizations sharing experiences in participatory breeding and supporting local seed systems in Latin America, Africa and Asia, has experienced in Vietnam and the Philippines that traditional products, notably rice, obtain higher market prices than the standard varieties. The benefits from these local resources return immediately to the originators when these are the farmers who produce for these markets (www.cbdcprogramme.org).

A recent example is the emphasis that the international initiative 'PEDIGREA' is putting on markets. PEDIGREA, which stands for Participatory Enhancement and Development of Genetic Resources in Asia, uses farmer-field school approaches to nurture farmers' interest and increase farmers' capabilities in the cultivation of diversity in Southeast Asia (www.pedigrea.org). One of the core activities is the inclusion of marketing strategies in the Farmer Field Schools organized in Indonesia, Cambodia and the Philippines, and the development of sustainable marketing chains which provide farmers with an incentive to grow such products (Wijk et al., 2004). PEDIGREA focuses on rice, vegetables and farm animal diversity.

Capturing value for diversity based products

Marketing mechanisms

In order to capture potential value in the market, diversity-based products need to have specific characteristics. Such values, which - ideally - should be readily observed, can relate to colour (red "Bordagol" rice in the Philippines) and shape (snake and bitter gourds throughout Asia), but the additional value may also be embedded in cooking and consumption qualities such as, for example, in the case of Basmati and Jasmine rice varieties in Asia, flint maize in Central America and various 'old' potato varieties in the Netherlands. Increasingly important in urban markets are emotional values attached to regional products. This is particularly outspoken in Europe where there is a strong tradition of clearly identifiable regional products of, for example, cheeses, wines and spirits. The current trend for ecologically produced products extends this to staples and vegetables. In urban areas in other continents, the emotional value attached to specific diversity is recognizable as well, as exemplified in the marketing of baskets of local (mixed) potato tubers in major cities in Andean countries. The capturing of emotional value is not likely to become mainstream, but niche markets can be large enough to stimulate diversity in the field in all continents.

The market value of diversity-based products depends on their visibility. The differences with the standard products should either be visible from the product itself, or be made visible in the market through packaging and labeling. An example of the latter is the emergence of a network of tortillerías in Mexico called 'Nuestra Maíz' (Our Maize) that use certified non-transgenic maize of local origin in their products. This network builds on social movements in Central Mexico and the Oaxaca region that want to protect the local maize culture against globalization in general

and the importation of maize from the USA (of which a significant part is likely to be of GMO-origin). The marketing is thus based on non-visible characteristics that are, however, highly 'visible' in the local press and local perception (http://www.nuestromaiz.com).

The cultivation of diversity can only be sustained and promoted if farmers manage to capture a good share of the additional value. The higher price at the farm gate should more than compensate for possibly lower yields or higher production costs. In order to reach an equitable sharing of the added value, farmers may have to organize themselves in order to protect their interests in the negotiations with traders and retailers.

In cases where the producers for the market are different from the communities that developed and maintained the diversity, a very different situation arises with regard to the sharing of benefits. For example, when commercial farmers close to the cities start producing farmers' varieties of local vegetables, the communities that developed the diversity and that are able to maintain it, are not likely to benefit. When this happens within a single country, the international agreements do not provide clear tools for benefit-sharing. And even when international markets can be reached by specialty products, the agreements do not always operate well. The famous Basmati case, where US producers and traders wanted to capture, and even protect, the value of the aromatic rice in the USA, thus reducing opportunities for the original custodians of the diversity in the Punjab, is a case in point.

It is thus important for the chain partners (farmers, traders, packers, and retailers) to reduce or at least manage outside competition in order to obtain a mark-up price in the market. This competition is primarily with standard products, and secondly with specialty products from other areas.

Both types of competition are important to deal with. Competition with standard products can be coped with through standard marketing tools, i.e. by stressing the specific qualities of the product, assisted by packaging and advertising. When a diversity-based product has established its niche market, the increased value may, however, attract free riders in other regions or other countries. Such free-riding requires new tools to protect the communities that originally developed and maintained the varieties concerned.

Legal mechanisms to manage competition - conventional IPRs

Intellectual Property Rights are designed to avoid different types of free-riding. The introduction of the concept of intellectual property rights (IPRs) in the field of genetic resources has generated significant debate in developing countries. Two aspects of this discussion are relevant in the context of this presentation: (1) the possibility to protect diverse varieties in the same manner as uniform varieties, and (2) the incompatibility of private ownership with the collective nature of genetic resources management in traditional farming communities.

Requirements for protection

Current discussions in several countries concerning the uniformity requirements of breeders' rights have focused on expanding opportunities for farmer-breeders to protect their varieties, both as an offensive, income-generating strategy and as a defensive strategy preventing misappropriation. Technically it is possible to describe genetically diverse varieties and the level of diversity they contain using methods and standards applied for open-pollinated varieties of cross-fertilizing crops. Legally, it is currently more difficult to protect such farmers' varieties, since the uniformity requirements in countries with UPOV-compatible PVP laws depend on the average uniformity levels of the protected varieties. More fundamental, however, is the fact that the protection of farmers' varieties is even more complicated since patents and PBRs only protect novel inventions, and most diversity-rich varieties are not new. Various countries, including India and Thailand, provide ways to protect extant varieties, but in most cases only when they are sufficiently uniform.

The second question is whether it would be beneficial at all for farmer-breeders to make use of formal PVP or patent protection systems. When they are not intending to commercialize the seed of their varieties – they may want to protect their niche-market for the diversity-based products instead – then this method is very expensive. Such defensive protection can also be achieved through a registration system of all local varieties, particularly if such registration system is linked to the register of protected varieties. Europe is currently debating this issue and seems to find a way out in the definition of 'conservation varieties', which are old and/or diverse varieties for which registration is likely to become possible alongside the UPOV framework. Registration does not provide protection, but at least some form of control through the seed law, which assigns maintainers to each variety, and through the certification requirements.

In such cases it is essential that the concept of essential derivation be applied to such registered varieties. This option is important because it is very easy to develop a distinct (new) variety out of a diverse farmers' population by simple selection techniques.

Secondly, implementation of the IT PGRFA and of the Bonn Guidelines under the CBD, and adaptation of intellectual property protection legislation to document the origin of germplasm used in breeding programmes should protect new farmers' varieties from misappropriation, and guarantee their continued availability in the public domain. This declaration of origin in patent and PVP applications, i.e. of the pedigree of a new variety or biological invention, is currently part of a hot debate in both CBD and WIPO circles. Opponents fear that applicants have to disclose valuable trade secrets to their competitors when they are forced to open their pedigree books.

A national register as referred to above would create a formal instrument by which misappropriation - through plant breeder's rights or patents - by third parties can be prevented, as this provides evidence of existence and origin of the variety concerned. Disclosure of origin requirements might be accompanied by a requirement that applicants provide evidence of Prior Informed Consent on the use of the materials

used in the breeding programme. However, strict regulations in this field cannot be easily monitored and the use of molecular tools is not going to provide a fool-proof system to check on pedigrees. In addition it is still unclear in many countries from whom PIC is needed, and farmer communities are not automatically included.

The collective nature of farmer-breeding

The incompatibility of private ownership and the collective nature of genetic resources in traditional farming communities is closely linked with the debate on alternative options for the protection of traditional knowledge. "Farmers have relied on the free movement of germplasm for millennia because traditional agriculture would have collapsed without it. Thus, free exchange of germplasm is embedded in farmers' culture and it is in this spirit that farmers have always freely shared their landraces." (Salazar et al., in press) This culture of free exchange, and treating all genetic varieties as raw materials for use and further improvement, has remained until the present day, even where farmers moved from subsistence farming to market-oriented and more intensive systems of production. The culture of availability is even one of the cornerstones of the PVP systems that have incorporated the concepts of the breeders' exemption and the farmers' privilege.

Assigning individual rights, such as PVP and patent rights, to an essentially collective system of plant breeding is inconsistent with that system, and will thus not be easy to implement at the local level. Although individual recognition is not an absolute taboo in farmers' systems, as shown by the fact that some varieties are directly attributed to specific individuals, the general rule is that farmers regard their breeding and selection efforts as a collective rather than an individual exercise. Likewise, the highly collective and informal nature of such breeding efforts can not be accommodated in current intellectual property rights systems. Current IPR systems may contain possibilities for joint applications for protection, but operating such rights with many right holders is virtually impossible. Current IPR systems are not designed for recognition of collective rights, and farmers' consciousness of collective breeding efforts generally does not value the IPR systems. Thus, adapting current IPR systems to incorporate protection of collective farmer-breeding efforts appears to be not an advisable approach, and protection of the efforts of farmer-breeding will have to be reached by other means.

Conventional intellectual property right systems for the protection of plant varieties are both technically and socially inappropriate to support diversity-based production

IPRs in marketing

Two types of rights that protect the marketing of products through alternative principles may provide valuable support for the creation of sustainable markets for diversity-based products: trademarks and geographic indications.

The former option is, similar to patent and breeders' rights, a private right that protects the signs and colours designed by the holder from use by competitors. One can imagine diversity-based products to be marketed under a trademark,

which allows advertising to become more effective. Trademarks are often owned by traders, processors, packers or retailers since they are the marketing specialists and know how to create value for the trademark through advertising. However, farmers' associations or unions can also use them to protect their markets. A big advantage of using trademarks in the protection of local products is that they are less likely to conflict with traditional farmers' perceptions about sharing seeds, since the legal position of the seed remains untouched by the introduction of trademarks.

The second option refers to geographic indications (GIs). GIs are indications which identify a good as originating from a country, region or locality, where a 'given quality, reputation or other characteristic of the good is essentially attributable to its geographic origin' (TRIPS, Article 22.1). The main advantage is that GIs are not private rights and are directly linked to the region (and community) that have developed the specific qualities assigned to the product. In other words, they do not focus on individual inventions, but rather relate to an area and may reward a community adhering to traditional practices. GIs may be considered attractive because these rights are held in perpetuity and the holders of a GI cannot assign the right to non-local producers (Sampaio, 2005).

GIs do not prevent the use of seed and local knowledge by others, but when the GIs are properly positioned in the market, others are not likely to reap the same benefits. An example may be the difference in price between true Champagne and different sparkling white wines from other regions which may have similar physical qualities, but the 'emotional quality' in the market of the product labelled as Champagne provides a serious advantage for the farmers in the Champagne region in France.

Serious debates currently take place in WTO circles about the number and types of products that can be protected. Currently, protection is limited to 'appellations d'origine' for beverages (such as Bordeaux wines) and food stuffs (such as Parma ham). Although positions of stakeholders are currently wide apart, it seems that countries have a lot of freedom to arrange for such types of protection within their borders.

GIs and diversity

The application of GIs to diversity-rich products in developing countries has not been widely implemented, and thus a thorough analysis of the opportunities and challenges of this concept is required.

The opportunities have been mentioned above: GIs can provide a protection in the market for specialty products from particular regions. Therefore, GI instruments may contribute to diversity in the market and to species diversity (such as orphan crops) or an increased number of varieties in the field, and thus to an increase in agro-biodiversity. It may also contribute to the continued use of diversity at the genetic level, but only if the market protection only applies to genetically diverse local varieties alone (as described in a register of local landraces/varieties).

The challenges are however multiple, the most important issues being the actual value of GIs in the market and the link of GIs with maintaining diversity.

Market value

The establishment of a brand-name in the market, identified and valued by the customer who is willing to pay a mark-up on the price of the standard product, is a major challenge. It is likely to succeed only when the product has a distinct added quality, such as taste, cooking qualities, specific processing practices, etc., even though less tangible added values can also create a market (viz. the 'Nuestra Maiz' network in Mexico). In particular, when a quality factor is not yet recognized in the market, the development of a special label is more complex and may require professional marketing tools. It is unlikely that smallholder farmers in a remote area can manage this complex task independently, and therefore it is a challenge for the genetic resources community to support such farmers, possibly through funds from a national gene fund or from benefit-sharing arrangements.

The success of a specialty product is likely to create competition. Other regions may come on the market with similar products, and since the seeds themselves are not protected, they may even produce the same product. Such copying behaviour is not prohibited; it fits in the farmers' tradition of sharing seeds and varieties, but these products may require less investment in marketing and may thus be offered at a lower price than the product of the original community. Further advertising by the original community using the applicable GI may be needed to strengthen the market position of the regional 'brand'.

The second challenge is how to maintain a link between the specialty product and the diversity in the field. When - after significant investments in developing a market for the specialty product - the production becomes profitable, it is likely that larger farmers in the region will (re-)gain an interest in that specialty market. They may try to render the farmers' variety more adapted to their farming methods through selection, and may eventually flood the market with a more uniform product with more or less the same specific qualities, possibly through cultivating (near-)uniform varieties. The biodiversity goals will then be largely lost. A solution may indeed be that the description of the geographic indication is linked with a particular set of registered varieties; for example, in some 'appellations d'origine' wines, the regional origin plus the type of grape and the methods of production are prescribed in order for the wines to carry the distinguishable label. To cite one example, the "Chianti Classico" wines from Tuscany are made from Sangiovese grapes, and only a limited number of vines per hectare may be planted and cultivated. This approach however creates additional control measures and - by definition - opportunities for fraud.

Finally, there is the question of international recognition of a national Geographic Indication or declaration of origin. This aspect is less important when local diversity and local markets are concerned (international markets generally require more uniform quality standards that call for more uniform varieties). The issue is currently discussed in the framework of the WTO negotiations.

Conclusions

Neither subsidies to farmers for maintaining genetic resources, based on government responsibilities to support the conservation and sustainable use of genetic resources, nor current and future international flow of funds through benefit-sharing agreements are likely to create sufficient tools for the sustainable conservation of genetic resources on-farm.

In addition to the upgrading of landraces and farmers' varieties through (participatory) plant breeding, the creation of markets is a necessary component towards the sustainable management of genetic resources on-farm. Whereas conventional intellectual property rights systems are incompatible with traditional farmers' practices of sharing seeds, the use of trademarks and geographic indications (other IPRs in the TRIPS Agreement) could offer opportunities for supporting and partly protecting (niche-) markets for diversity-based specialty products.

Challenges involved include

i) providing investments and marketing expertise required for the creation of a quality label to support the marketing of a (specialty) product
ii) securing the link between the markets and diversity
iii) generating international recognition for a greatly extended number of geographic indications (in number and scope) as is currently under debate
iv) preventing misuse; as with any other legislation, increased numbers of rules create new opportunities for fraud.

Both further research on the viability of the approaches presented above, and pilot investments in the creation of markets for biodiversity-based products could be paid in part from funds developed within the framework of benefit-sharing mechanisms of the international agreements.

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Abbreviations and Acronyms

CBD	Convention on Biological Diversity
FAO	Food and Agriculture Organisation of the United Nations
GI	Geographic indication
GMO	Genetically modified organism
IARCS	International Agricultural Research Centres
IPR	Intellectual property rights
IT-PGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
PEDIGREA	Participatory Enhancement and Development of Genetic Resources in Asia
PIC	Prior Informed Consent
PVP	Plant Variety Protection
TRIPS	Trade-related aspects of intellectual property rights
USDA	United States Department of Agriculture
UPOV	The International Union for the Protection of New Varieties of Plants
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

Indian legislation on biodiversity

by M.S. Swaminathan[1]

At the beginning of a new century and millennium, India enacted two important legislations related to biodiversity. These are the Protection of Plant Varieties and Farmers' Rights Act (PPVFR Act) of 2001, and the Biological Diversity Act (BD Act) of 2002. The first was devised to provide *sui generis* protection to plant varieties in compliance with India's commitment to the Trade Related aspects of Intellectual Property Rights (TRIPS). The second establishes legal sovereignty over India's biological diversity and provides a framework for its conservation, sustainable use, access and benefit sharing, in accordance with the provisions of the Convention on Biological Diversity (CBD), 1993.

Before going into these legislations in detail, let me state how we would like to relate biodiversity in accomplishing the first of the Millennium Development Goals, namely reduction of poverty and hunger, which is the theme of this Consultation. I think we should keep our focus on this theme without drifting away to look at the other important roles that biodiversity ecosystem conservation can play. If we want to make a significant contribution to reducing hunger and poverty, one of the pathways is to increase the productivity of small farms; farms of the size of one hectare or less. The Inter Academy Council report on African Agriculture, as well as the national studies undertaken by MSSRF, have brought to focus that with a very large number of people engaged in agriculture, the majority of them being small and resource poor farmers, and also many among them struggling for a livelihood in semi-arid, arid or other such harsh agro-climatic conditions, there is need to increase farm productivity on an ecologically sustainable basis (Swaminathan, 1996; IAC Report, 2004). The smaller the farm, the greater is the need for marketable surplus. When these farmers produce one ton per hectare, they may keep the produce for themselves, but when they produce four tons from the same land holding, they generate marketable surplus. So, cash income and food security will come concurrently to such farm families only by increased productivity. The primary catalytic technology for increasing crop productivity is the seed. Other productive inputs, such as fertilizers, water and pesticides, are important, but their impact on yield is high only with good seed. That is why biodiversity conservation and sustainable and equitable use are fundamental to achieving Millennium Development Goal number one.

By helping to increase productivity leading to enhanced income, enhanced food availability, employment and growth in agri-business, crop and variety diversity contribute to the reduction of poverty and hunger. Hence, it is important to ensure that the benefits of modern science and technology with regard to seed

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development - whether by conventional Mendelian breeding, molecular breeding, or a combination of both - are made accessible to all, without social exclusion of the small and resource poor farmers. Social exclusion from accessing these technologies will not take us to poverty reduction or removal of hunger, but will only lead to enlarging the rich-poor divide and to greater social unrest, which the world has been witnessing for the last ten years. There is an increasing consensus that with increased globalization, poverty and hunger in many countries has increased rather than diminished. And, therefore, the strategy we chalk out from this consultation should help in removing impediments to technology access, and thereby rescue millions of resource-poor farm families from the poverty and hunger trap.

Protection of Plant Varieties and Farmers' Rights Act

This Act confers three concurrent rights: the plant breeders' right (PBR), the researchers' right and the farmers' right. When Indian agriculture entered and passed through the 'Green Revolution' phase in its agricultural evolution during the sixties, none of the technology providers or players engaged in technology transfer felt that the lack of plant breeders' rights or patent right is a hindrance to technology generation. Unrestricted exchange of material and technologies among institutions, and between institutions and farmers, had helped to bring about a revolutionary change in crop productivity and production. Had there been a restriction in the exchange of material, the CGIAR gene banks would not have received so many accessions. Much of these collections were given by national governments and national agencies. CGIAR became the custodian of these collections and facilitator to use them to enhance agricultural production. Had there been the kind of possessiveness over plant genetic resources and the greed we see today for privatizing them, such transfer of material from national governments and other agencies would not have happened. Hence, there is a need to reciprocate this trust with ethics and equity in the access to and use of biodiversity. It is satisfying that both the Convention on Biological Diversity and the International Treaty on Plant Genetic Resources for Food and Agriculture (IT) have mainstreamed principles of ethics and equity in matters of access and benefit sharing.

I am pleased to share with you the fact that the initial drafts of both these Acts, the PPVFR Act and the BD Act, were developed in this very conference hall and given to the government of India, and the Acts passed by the Indian Parliament have retained most of the features contained in the original drafts (Swaminathan, 1995). Subsequent to the passage of the PPVFR Act by the Indian Parliament, our Foundation under the leadership of Dr S. Bala Ravi developed Rules for the implementation of this Act (MSSRF, 2002). We had taken particular care to ensure that these implementation rules are strongly engendered, in view of the predominant role of women farmers in the Conservation-Cultivation-Consumption-Commerce chain. In this respect also, this is the only *sui generis* legislation in the world that has integrated the rights of farmers and breeders, and also the gender perspective. Those who are particularly interested in engendering the biodiversity-related rules for implementation might like to refer to our work on the PPVFR Act and BD Act (MSSRF, 2003).

The PPVFR Act is unique among similar legislations anywhere in the world, as far as we know at the moment. One aspect of this uniqueness is that it confers three concurrent rights – breeders', farmers' and researchers' rights. The underlying philosophy is that farmers and breeders are engaged in the same struggle for food security, improving varieties for producing more and better food. Their rights should not be seen as antagonistic, but complementary. Without farmers or their welfare, there is no durable role for breeders and without farmers' rights on seed, there can be no generation of plant genetic variability essential for future breeding. Hence, an integrated protection of breeders' and farmers' rights on plant varieties is important. The Indian *sui generis* legislation on plant varieties, therefore, harmonizes the interests of both farmers and breeders. I hope this will ultimately stimulate UPOV to become an International Union for Breeders' and Farmers' Rights.

The plant breeders' rights (PBR) in the PPVFR Act are identical to such rights provided in the other *sui generis* legislations on plant variety protection in many countries and particularly in the UPOV Convention, 1978. But the difference is in the exclusivity of the PBR. While the UPOV 1978 and 1991 have been making the PBR more and more exclusive by denying farmers' rights and reducing it to an auxiliary and curtailable 'farmers' privilege', the PBR under the PPVFR Act is integrated with farmers' rights and researchers' rights. For the purpose of the farmers' rights, the PPVFR Act recognizes the multiple roles of farmers in relation to biodiversity and defines the farmer accordingly. The Act recognizes three important roles of the farmer, both women and men, as the cultivator, as the conserver of agro-biodiversity and as a breeder capable of selecting and improving land races. As conservers and selectors, farmers have been exercising innovative skills in improving and value-adding plant genetic resources and in enriching the associated traditional knowledge. In recognition of the roles of farmers as cultivators and conservers, the farmers' right conferred by the PPVFR Act has entitlement to retain and maintain farmers' own seed systems, as traditionally practiced by them. This Act grants rights to farmers to establish breeder's right on varieties selected and/or conserved by them in the same manner in which such right is granted to breeders on extant varieties. This grant is not based on the farmer's academic qualification but on the qualifying criteria specified for farmers' variety under the Act. There are several successful instances in India, even now, where popular varieties have been identified by farmers from the variability - either natural or artificially generated - in vegetative propagated or self-pollinated crops (NIF, 2005). This farmers' skill had been the underlying reason for genetic variability and its enhancement in the past and present, in countries such as India - endowed with high genetic variability in crops. Recognition of this skill among farmers and their contribution to plant genetic variability is an important component of farmers' rights in the PPVFR Act. In recognition of these important roles of Indian farmers, the Act provides for reward and recognition, and equitable benefit sharing.

One of the objectives of the PPVFR Act is to promote more private investment in plant breeding. This is significant in the context that most of the investment in plant breeding in India is from the public sector. The Green Revolution, as many analysts

have said, was a product of public sector research. The 'Green Revolution' technology was a public good, generated by the institutional synergy between the IARCs originally founded by the Rockefeller and Ford Foundations and later integrated with CGIAR, and the national public research system established by the Indian government. Unlike this, the gene revolution or the anticipated revolution from molecular breeding has a large component of the private sector, embedded with high-intensity intellectual property rights. In fact, that is why this issue has gradually become important. As the private sector's role has grown, proprietary rights, such as patent on technologies, have also grown. As long as the public sector retained dominance in technology generation, this question did not arise at all, either in medicine or in agriculture.

Coming to the plant variety sector in India, over 75% of the seed system is still constituted by farmers' own seeds. Barely 25 per cent is held by the private sector, hybrids constituting a large portion of it. Nearly 90 per cent of the commercial hybrid seed supply is controlled by the private seed sector, while the non-hybrid seed sector is largely in the hands of farmers. The private sector is not investing in varieties of self-pollinated or vegetative propagated crops because the seed system of these crops offers no foolproof technological protection, in the absence of rigorous IPR protection. This is promoting private investment in areas offering technological exclusivity, such as hybrids, where the parental lines can be kept in secrecy or exclusive, and more recently in the modern gene manipulation technology. The only genetically-engineered crop variety released for general cultivation in India up to now is the Bt-cotton hybrid carrying the Cry1Ac gene from *Bacillus thuringiensis.*

The PPVFR Act grants PBR on new and extant varieties, including farmers' varieties. The qualifying requirements for the granting of this right on a new variety are novelty, distinctiveness, uniformity and stability, as under UPOV. However, unlike the UPOV, the PPVFR Act allows one time registration of extant or farmers' variety on satisfaction of its distinctiveness, uniformity and stability. The registration of these varieties is allowed only during the first three years from the date of implementation of this Act. The duration of granted PBR subject to its maintenance, is identical to that under UPOV 1978; 15 years for annual species and 18 years for tree and vine species. Notwithstanding this eligible period, the initial grant is only for six and nine years, respectively, with a provision to extend the period to the full duration on PBR holder's option. Frequently, the period of protection offered by the *sui generis* PVP laws of different countries has minor deviations. The PBR granted under PPVFR Act does not exclude researchers' rights or farmers' rights. The researchers' right allows unrestricted access to plant genetic resources, including PBR protected varieties, for the purpose of research by breeders and researchers. An important feature of the PPVFR Act, which is absent in the UPOV system, is the liability on the part of the PBR holder to fulfill the requirement for equitable benefit sharing, when the protected variety is bred from varieties, including farmers' varieties, or land races or wild species conserved by farmers.

Liability of a protected variety for compulsory licensing is an essential feature of the PPVFR Act. Since approximately 80 per cent of the operational farm holding in India is very small in size (less than 2 ha) and much of the rural poverty is associated

with these farming families and landless agricultural labour, it is important to ensure that all varieties offering economic benefit are made equally accessible to these farmers or, rather, that they are not selectively excluded from accessibility to these varieties merely on the grounds of high cost. For example, if one develops a new superior variety with a very high degree of resistance to certain common pests or/and diseases, it is important that such varieties be made accessible to every farmer and not only to those who can gain access by paying high prices for the seed. Some question the need and necessity for compulsory licensing. I think the Doha discussions under WTO provided sufficient reason. If it is to be true in health security, it must also be so in food security, for there can be no health security without food security. For example, when a crop production system of a country is being devastated by a major disease outbreak – such as the chronic coconut wilt disease of India - which severely harms the livelihoods of millions of farmers, and when some scientific solution is made available, it is important that such solution be accessible to all farmers. A technology with potential to make a difference in poverty, but which is not accessible to the poor, for reasons of disputable high cost, is probably worse than not having such technology. In such situations, compulsory license could be a useful public interest device. The PPVFR Act has well-defined criteria with calibrated steps to invoke compulsory license.

Our Foundation is a non-governmental organization engaged in R&D activities funded mostly by donor agencies. Our R&D also includes pre-breeding to generate novel genetic combinations and farmer participatory breeding. This approach offers a new genetic combination in economically-useful traits and facilitates the sharpening of farmers' skills in identifying and selecting varieties suited to their growing cultural and market conditions. Participatory breeding promotes variability at farm level and minimizes the disadvantages of the IPR regime on seeds. Monoculture of crop and variety is unsustainable. When I was head of the International Rice Research Institute in the Philippines, IR36 had a coverage of about 10 million hectares in Indonesia. This gave us anxious moments with regard to the possible risk of the variety suffering a set-back not known to us. If any unknown agronomic defect becomes manifest in such a widely-grown single variety, the impact of such set back could be catastrophic to the farmers and to the country. Hence, it is very important not to depend on one or just a few varieties in any crop - however agronomically superior they might be - but to broad-base the farming with variety diversity suited to farmers' preferences and agro-ecological niches. Participatory variety selection and promotion of farmers' varieties with legal rights, as provided in the PPVFR Act, are routes to encourage variety diversity.

Another feature of the PPVFR Act is that it does not grant PBR on varieties possessing genetic use restriction technologies (GURT) or the 'terminator gene technology', as it is popularly called. The Act makes it mandatory to the applicant for PBR to swear, by affidavit, that the candidate variety is free from any form of GURT. This is important to India, to avoid the environmental contamination of such genes harmful to the domestic genetic diversity in various crops and in view of the potential of these genes to nullify the farmers' rights provided in the PPVFR Act.

Yet another feature of the PPVFR Act is the provision for establishing a National Gene Fund (NGF). The fund flow into the NGF is largely from national and international donations for the conservation of plant genetic resources, from annual fees received for the maintenance of PBR on varieties, and from the receipts related to benefit share and compensation. The outflow of funds from NGF will be largely to promote the conservation of plant genetic resources, to reward and recognize leading individual and community conservers and to pay benefit sharing and compensation. The Crop Diversity Trust Fund established under the International Treaty on PGRFA is also expected to support conservation in PGR-rich developing countries.

Consistent with the CBD and Indian legislation on Biological Diversity, the PPVFR Act has provided for equitable benefit sharing from the commercial gains made from a PBR protected variety. Eligibility of parties, as well as the kind of benefit, will be decided upon depending on the genetic resources used for the breeding of such protected variety. The Act and its Rules indicate how this process will be carried out. All PBR applicants are required to declare the geographical source of parental material used in the breeding, how these materials were accessed and the contribution of such material to the candidate variety. This information is used to guide the benefit-sharing decision, which is done wherever required, soon after the granting of PBR. When varieties are bred with multiple parental lines and these parental lines are derived from multiple crosses, some of them involving farmers' varieties, it is not easy to pin down eligibility for benefit-sharing with the farming community that had provided the initial breeding stocks. Here, systematic pedigree record and honest declaration of parental material used by breeders become important to their professional ethics. However, in some cases, the origin of parental material can be easily tracked down. An example is the resistance to 'grassy stunt' virus or brown plant hopper (BPH) or bacterial sheath blight in rice. The initial source of resistance to grassy stunt virus is a wild species of rice, *Oryza nivara,* which is endemic to eastern parts of Uttar Pradesh in India. Similarly, the bacterial sheath blight resistance gene is found in the African wild rice, *Oryza longistaminata,* endemic to Mali. In the same way, resistance to BPH was initially identified from PTB 33 and a very few other varieties from Kerala and Assam, in India. These genes transferred to elite breeding lines have played an important role in revolutionizing rice production, when all earlier varieties became susceptible to these biotic stresses. Therefore, whenever a new rice variety carrying these genes is registered for PBR, the farming communities of the said regions become automatically eligible for benefit sharing. There are many such genes, which facilitate the easier determination of benefit sharing. Nevertheless, the matter can become complex in many other cases.

The PBR provided in the PPVFR Act is similar to that under UPOV 1978 and 1991, in respect of essentially derived varieties. However, the UPOV seems to have reservations in approving Indian *sui generis* legislation on the grounds of farmers' rights provided therein. This is wrong, in my view. As I said long ago, in my Sir John Crawford memorial lecture in the CGIAR, the UPOV must become the "union for the protection of breeders' and farmers' rights" (Swaminathan, 1990). UPOV needs to be reformed, in relation to the scope of farmers' rights it allows, rather than it trying

to reform others for abandoning farmers' rights. UPOV should integrate breeders' and farmers' rights to make it a universal *sui generis* system from the present *sui generis* system, suited and restricted to the agriculture of rich countries. The current UPOV framework will neither facilitate the achievement of the UN Millennium Development Goal on reduction of poverty and hunger in poor countries, nor assist in conserving the plant genetic resources for food and agriculture.

The researchers' right allowed under the PPVFR Act is unrestricted, except in the case of repeated use of an already-protected variety, as a parental line for the commercial production of a new variety to be registered under this Act. In the latter case, authorization of the PBR holder of such a parental line is essential. Similarly, in the case of breeding an essentially derived variety, its commercialization after registration under this Act can be taken up only with an authorization from the provider of the initial variety. In this respect, the PPVFR Act has a certain similarity with the UPOV 1991.

Unlike in developed countries, where the economic status of farmers is far better, their resource capability far higher and their role in conservation of plant genetic resources either zero or far smaller, the farmers in agro-biodiversity-rich developing countries have been traditionally performing the most important 'public good' role by conserving and enriching large plant genetic variability. This plant genetic variability is important, not only to the source countries but also to the world at large. In a world where the climate is changing, such on-farm conservation alone will provide new genes and adaptive gene complexes for its future food and nutritional security. In cognizance of this bare truth and affirming that farmers, particularly those in the regions rich in plant genetic resources, have an important role in conserving, improving and making available the plant genetic resources, the International Treaty on PGRFA has accorded global legal binding to farmers' rights. This Treaty defined farmers' rights as the right to save, use, exchange, and sell farm-saved seed and other propagating material and to participate in decision-making with regard to, and in the fair and equitable sharing of, the benefits arising from the use of plant genetic resources. While the Indian PPVFR Act is consistent with this Treaty, the UPOV falls far short in recognizing and legitimizing farmers' rights.

Farmers' Rights in the PPVFR Act include the traditional right to save, use, sow, exchange, share or sell seed of a cultivated variety, protected or not; entitlement for reward and recognition for conserving and improving genetic resources; right for registering farmers' varieties; and right for benefit sharing. The right to sell farm-saved seed excludes branded seed of a protected variety. In the Indian context, sharing, exchanging and selling of farm-saved seeds usually takes place only in the nearest neighborhood and more often in highly self-pollinated and vegetative propagated crops. Farmers tend to buy seed for every sowing when the cost is affordable and the seed is available at the right time.

Traditional communities in the developing world are not only the rich owners of bio-resources, including plant genetic resources, but also holders of equally rich traditional knowledge. Both these assets have more recently become easy commodities for piracy and appropriation under the IPR regime offered by the

TRIPS. In response to this unethical global tendency, India has initiated work to establish a documentary and digital database on national traditional knowledge and community innovations. The National Innovation Foundation established in India has created a digital library of all farmers' innovations, including new varieties, farmers' varieties, community or individual innovations from rural areas, and other kinds of traditional wisdom and traditional knowledge (NIF, 2005). Like in many other countries rich in biodiversity, India has a rich traditional knowledge associated with its biodiversity. The IPR regime being promoted under TRIPS not only denies economic benefits to traditional innovators, but also helps in getting their innovations robbed by the 'modern innovators'. The principle of access to traditional knowledge and biological resources with prior informed consent, material or knowledge transfer agreement, truthful acknowledgement of prior art, and benefit sharing, becomes important in this context as a legal and ethical requirement. In the first instance, such benefit sharing in India took place before the CBD was concluded. This was the case of *Kani* tribes in the western ghat region of India and an endemic wild herb locally known as '*arogyapacha*' (T*richopus zeylanicus travancoricus*) (Pushpangadan et al., 1988). The *Kani* tribe held the knowledge on an anti-fatigue property of this herb. The scientists with whom this traditional knowledge excusive to the *Kani* tribe was shared, eventually detected the anti-fatigue molecules. Commercialisation of this product, called 'Jeevani', led to sharing the benefit with the *Kani* tribe. It is important to mention that, at that time, there was no legislation in India entitling the tribal community to receive such benefit share, nor had the CBD come into force. The benefit sharing was done at the behest of involved scientists on principles of ethics, equity and professional morality.

The PPVFR Act is to be implemented and administered by an autonomous PPVFR Authority, which is to be set up shortly[2]. All legal disputes and issues arising from the PPVFR Act during its implementation are to be judicially and judiciously addressed by a dedicated Plant Varieties Protection Appellate Tribunal provided under this Act.

Biological Diversity Act

India is one of the few countries that have instituted national legislation on biological diversity. The aim is to establish sovereign right over national biodiversity and to manage its conservation, sustainable use and benefit-sharing, arising out of its commercial use in keeping with the Convention on Biological Diversity. The BD Act of India was passed by Parliament in 2002. The implementation text 'Rules on this Act' was published in 2003. The Act is under enforcement since 2004. An Authority called the National Biodiversity Authority (NBA) of India is responsible for the administration of this Act. The office of NBA is located in Chennai.

[2] This has since been set up, in November 2005

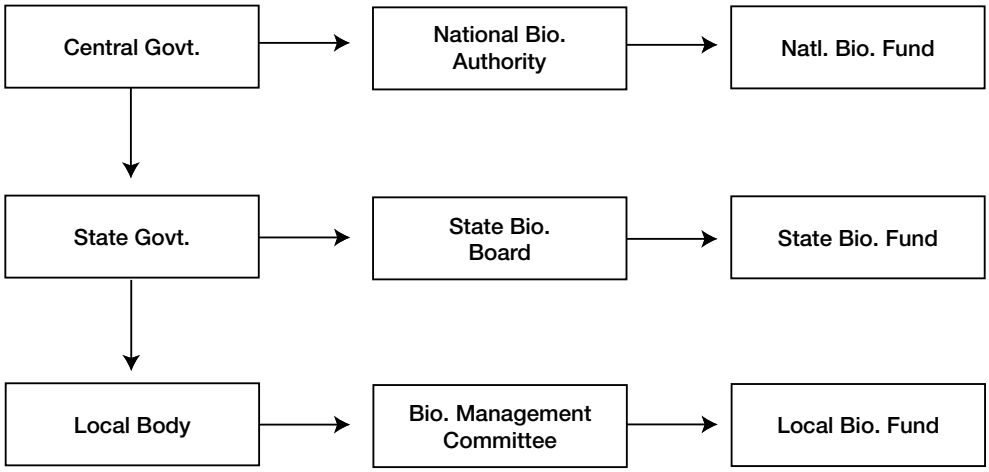

Figure 1. Administrative set up of Biodiversity Management in India

India is a very large country with many states and a federal constitution, and its biodiversity is spread across all the states. The lives and livelihood of its large population are heavily dependent on several components of biodiversity. Therefore, a three-tier biodiversity management system, with its base at village level, is provided in the Act (Fig 1). Instead of directly involving communities at the grass root level, an elected representative body at village level, called *Panchayat,* is made responsible for management of biodiversity and decision-making on access and benefit-sharing at community/village level. Under the Indian democratic system, a *Panchayat* is elected once in five years and is responsible for local governance. A technical committee called the Biodiversity Management Committee (BMC) is nominated at each *Panchayat,* to assist in administering the biodiversity-related matters in accordance with the BD Act and rules and regulations decided by the concerned State Biodiversity Board. Each BMC is mandated to have at least one-third of its membership comprising women. India has about three million elected *Panchayat* representatives, out of whom one million or one-third are women, many among them chairing the *Panchayats*. Alternative self-government institutions exist in certain regions of the country, where the *Panchayat* or Municipality does not exist. The BMC within its jurisdiction will promote the conservation and sustainable use of local biodiversity, including land races, wild species, important habitats, animal breeds and microorganisms, and also extensive documentation on same, in a People's Biodiversity Register. Each Indian state is required to establish a State Biodiversity Board to govern, assist and coordinate the BMCs in administering the biodiversity and associated traditional knowledge (TK) within its jurisdiction. The National Biodiversity Authority (NBA) at apex level assists and coordinates with all states in the management and administration of this Act. These three biodiversity

administration institutions are linked to the central, respective state governments and the elected body, such as the *Panchayat*. They are also supported financially at each level with a funding system (Fig 1). The National Biodiversity Fund (like the NGF under the PPVFR Act) assists in channeling the benefit share to the primary conservers.

The NBA alone is vested with the authority to decide on whether a non-Indian citizen or entity may access biodiversity and associated TK. It is mandatory that such access be made only with the prior approval of the NBA. Similarly, there are clear provisions and guidelines regarding collaborative research with non-Indian entities or transfer of research data and information on Indian biodiversity to such entities. All bio-prospecting, bio-utilization and commercial utilization of biodiversity or associated TK by Indian entities or persons is required to be undertaken with prior intimation to the concerned State Biodiversity Board. During such access by Indian entities, the *Panchayats* are empowered to levy a collection fee and to regulate such commercial uses to ensure sustainability.

All IPRs on processes or products arising from Indian biodiversity or associated TK must receive the prior approval of the NBA, in order to be established. During such approval for IPR, the NBA may decide on the terms of equitable benefit sharing. Such benefit sharing may involve monetary or non-monetary components including joint ventures, venture capital funds, technology transfer, institutional capacity building, product development, etc. Such benefit shall also be linked to conservation and sustainable use. It is hoped that the mandatory provision for the NBA to grant prior approval on applications for IPR connected with Indian biodiversity or associated TK may prevent bio-piracy, like the notorious patents on turmeric, neem, etc. In this context, the NBA is authorized to challenge, contest and get revoked any global patent illegitimately established by any party on Indian biodiversity or associated TK. The establishment of a digital library on TK is expected to help in challenging such pirated patents.

So, ladies and gentlemen, these two Acts have certain common features, like in many international agreements, and each one of them also has its own unique features. We shall be very happy to assist those national governments or institutions who are interested in knowing more about these Acts and their implementation rules, including engendering these rules to ensure equity and ethics in accessing and using bio-resources and associated TK, which are the common heritage of the people and communities of each nation.

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Abbreviations and Acronyms

BD	Biological diversity
BMC	Biodiversity Management Committee
BPH	Brown plant hopper
CBD	Convention on Biodiversity
CGIAR	Consultative Group on International Agricultural Research
GURT	Genetic use restriction technologies
IAC	Inter Academy Council
IARC	International Agricultural Research Center
IPR	Intellectual Property Rights
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
NBA	National Biodiversity Authority
NBF	National Biodiversity Fund
NGF	National Gene Fund
NIF	National Innovation Foundation
TK	Traditional knowledge
UPOV	International Union for the Protection of New Varieties of Plants
PBR	Plant Breeders' Rights
PPVFR	Protection of Plant Varieties and Farmers' Rights
R&D	Research and development
SBB	State Biodiversity Board
TRIPS	Trade-related aspects of international property rights
WTO	World Trade Organization

Protecting and strengthening local food systems: harnessing biodiversity and indigenous knowledge for food security, livelihoods and nutrition

by L. Bhattacharjee[1], F. Egal[2], L. Collette[3], B. Burlingame[4], B.K. Nandi[5] and H. Kuhnlein[6]

Introduction

Understanding local food systems and addressing issues related to biodiversity in the context of food security, livelihoods and nutrition, pose unique challenges. Existing knowledge warrants immediate action to promote the use of biodiversity in food security and nutrition programmes, as major steps towards the path to achieving the Millennium Development Goals (MDGs). The mandate of the Food and Agriculture Organization of the United Nations (FAO) provides a broad basis for conserving and using biological diversity in all its forms. Unique to FAO is the fact that its policies and programmes on biodiversity are defined in agreement with its members. Given its broad mandate related to conservation and use of biodiversity, FAO is asserting global leadership in biological diversity for the international community.

This paper provides a brief summary of FAO's activities on: (a) Indigenous peoples' food systems, dietary diversity and nutrition in Asia; (b) Home garden models integrating agricultural production with nutrition awareness in Lao PDR; and (c) Support in the National Agricultural Biodiversity Programme in Lao PDR.

Documenting Indigenous Peoples' Food Systems

Improving the food security, nutrition and health status of indigenous peoples who reside in their homelands in rural areas requires a thorough understanding of the local environment and traditional food system known and used by their culture. Indigenous peoples often use unique food species and processing methods, and the traditional knowledge required is often as endangered as the species themselves (Kuhnlein, et al., 2003).

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FAO –CINE Asia Case Studies

In 2001-2002, FAO's Food and Nutrition Division, in collaboration with the Center for Indigenous Peoples' Nutrition and Environment (CINE), documented the need for specifically addressing the traditional food systems of indigenous peoples with a focus on the nutrient composition of traditional foods and the unique environmental and cultural constraints and benefits of traditional foods to address the adequate nutrition of several micronutrients in communities. As part of the short-term goals, five case studies in Asia defined the method for documenting indigenous peoples' food resources and the long term goal for using these resources for programme planning to ensure adequate diets and good nutritional status (Kuhnlein, et al., 2003,2004). The five case studies were carried out in four Asian countries: *Bangladesh,* in collaboration with the Mogh Tribals and Nayakrishi Farmers of Cox's Bazaar District, with guidance from the Policy Research for Development Alternatives (UBINIG) Dhaka; *China,* in collaboration with Miao National Minority of Sichuan Province, with guidance from the Chinese Academy of Preventive Medicine and Institute of Nutrition and Food Hygiene, Chinese Academy of Preventive Medicine, Beijing; *India,* in collaboration with Bhil tribals in Gujarat State, with guidance from the Child Eye Care Charitable Trust (CECCT); and Dalit farmers in Andhra Pradesh State, with guidance from Deccan Development Society and the National Institute of Nutrition, Hyderabad; and *Thailand*, in collaboration with the Karen People of Kanchanaburi Province, with guidance from Mahidol University, Salaya (Kuhnlein, et al., 2004).

At this point 90,276 food species have been documented in the five areas, with some species yet to be analyzed. Some qualitative and quantitative data are also being analyzed to evaluate the potential of the local food system for improving nutritional (micronutrient) status. Some of the case studies are on-going, in collaboration with a Global Health Research Project, CINE, and Mc Gill University, Canada.

Bhil Case Study, Gujarat

The Bhil Case Study from Gujarat, India, documented the Bhil traditional food system, pointing to the nutrient composition and use of 97 foods including a variety of plants, domestic and small animals and local fish, with preparation and processing methods unique to the Bhil culture. It was noted that the nutritive values including the macro- and micronutrient content of 16 locally-grown vegetables and fruits were not available in the Indian food composition tables and needed to be analyzed, while other foods needed to be identified scientifically before analysis for nutrient content. The mineral content for calcium, iron, copper, zinc, magnesium and phosphorus of five traditional foods – junglikhand (a type of wild tuber), mokha leaves (tough green leaves), vasarta (a type of mushroom grown on the bamboo tree), teruna leaves (a type of tuber leaves) and doli mahuda seeds (fruit seeds) – were analyzed at the National Institute of Nutrition in Hyderabad, India (Rao, 2002). Two of these traditional foods, namely, doli mahuda fruit seeds (*Bassia latifolia*) and teruna leaves (*Colocasia/Chlorophytum*) have been scientifically identified while identification of the others still needs to be done. Dried vasarta (mushroom), as it is commonly used,

has a protein content of 20 g per 100 g and can serve as an inexpensive and potential source of protein in the Bhil diet.

Dietary assessment showed that children and mothers ate micronutrient-rich foods approximately once or twice a week and that the dietary energy and protein intakes of most pregnant women and preschoolers did not meet the Indian Recommended Dietary Allowances. Anthropometric data of women and children showed short stature and low body weight, consistent with malnutrition according to the US National Centre for Health Statistics (NCHS) standards. Within the context of the Bhils' traditional food system, there exists a high potential to promote the use of a variety of micronutrient-rich foods in the diet. This can help to increase dietary diversity and serve to meet their micronutrient requirements.

The Bhil knowledge base generated so far is currently being used to facilitate food-based nutrition and health promotion programmes which have been proposed as part of the on-going Global Health Research Project, indicated earlier. It is intended that a sustainable base of community-led activities for the improvement of food security, nutrition and health - with implications for community-friendly policies and programmes - will be direct outcomes of the project.

Need for diet and nutrient composition

The FAO experience has shown that working with indigenous peoples' food systems requires recognition that indigenous peoples universally prefer health promotion activities using their local food. Implementation of the method stressed in all cases that a community-based approach can be successful, using interdisciplinary and participatory methods. Understanding the unique local species and varieties of food often requires new identification, food analysis and dietary assessment methods appropriate to the community context in which they are applied (Kunhlein, et al., 2003). Acquiring nutrient data and intake data for food species and varieties is essential in order to understand the impact of biodiversity on food security.

Home gardens – linkages between agricultural biodiversity and food security

Home gardens are good examples of the close link between biodiversity and food security. They are important micro-environments for *in situ* or on-farm conservation of a wide range of plant genes and, additionally, provide essential sources of food, fodder, medicines, spices, construction materials and income for rural households in many countries around the world. The biodiversity found in such gardens gives households access to a large variety of nutritious foods, thus providing opportunities for better nutrition, food security and income.

Home Gardens also serve as informal plant introduction and distribution centres: seeds and information are exchanged among gardens, families and local markets, which can enable new genetic diversity to evolve. Furthermore, home gardens are a place for experimentation with new species and varieties, thereby playing a vital role in crop improvement and evolution. A central function is that of *production*

centres, where crops that are eaten daily or need specific attention, are planted. Such gardens are home to the cultivation of species that are under-utilized from a research and broader economic perspective, and thus play an important role in national agro-biodiversity conservation strategies. Since home gardens are an important place for use, introduction and experimentation with a variety of species, they are a refuge for genetic diversity. There is often a great variety both in terms of species and also within species. (Engels, 2001)

Genetic diversity has an important impact on both production aspects and food security. It is widely recognized that genetic diversity in a farming system provides more crop stability in terms of yield, and this has an important impact on food security. Furthermore, it also enables more sustainable production methods, as the interaction between the diversity of plants lowers dependency on chemicals and other external inputs. This, in turn, provides a place where plants, animals, insects, micro-organisms and the soil interact, thus maintaining the agro-ecological balance and protecting the soil from erosion. (Engels, 2001; Trinh, et al., 2001).

Diversity of plant species makes an important contribution to improving the nutrition of rural and urban families. Fruit and vegetables cultivated in home gardens are rich in micronutrients and increase diversity of diet, thereby preventing various diseases and malnutrition. This is especially true when garden-raised meats are used to add important protein. Women are vital to the management, production and utilization of produce from home gardens. This includes selecting and storing seeds, planting, weeding, and using the produce in the household or selling it. Women's role in conserving local varieties is important and their knowledge has been vital in resource enhancement. (Engels, 2001).

Types of home gardens and use of plants /crops

Home gardens seem to be found in many areas of Laos, although there is limited knowledge about their impact on food security and biodiversity. Observations and experience from projects indicate that there are many types of home gardens, and that they vary in size, crops and techniques used. A two-district survey of indigenous agro-forestry practices by the Lao-Swedish Upland Agriculture and Forestry Research Programme (LSUAFRP) and the Northern Agriculture and Forestry Research Centre recorded that, in both districts, home gardens are well-known and widespread, and in almost every village there is some kind of home garden present (Dyg and Phithiyaphone, 2004). In both districts, there are different kinds of home gardens but also similarities among them. Crops include fruit (papaya, banana, citrus, pineapples, mango and jackfruit) and vegetables (eggplants, chilli, cabbage, beans) plus ginger, taro, bitter bamboo, peanuts and various medicinal plants. In one home garden, in the mountains of Phonxay, more than 50 different plants were grown (Sodarak, et al., 2003).

Domestication of Non-Timber Forest Products (NTFPs) is also common in home gardens with gardens based on planting bitter bamboo. The bamboo stems are collected from the surrounding forests and planted close to the houses, between pineapples and fruit (Sodarak, et al., 2003). Some small gardens are found on

table tops and bigger home gardens are grown on the ground, where vegetables are intercropped with rice or corn and fruits trees are common as contours along the borders of the garden or scattered within the plot. Home gardens are found in all kinds of environments, from mountain tops to close to rivers in lowland areas. The LSUAFRP also documented that some farmers had developed home gardens into larger gardens containing several production factors. These included different plants, such as teak, fruit trees, vegetables, rice, corn and cassava. In addition, the systems also contained protein sources, such as fish-ponds, pig and poultry raising. Such systems are referred to as 'advanced farming systems' or 'household-based integrated agricultural production systems', which are very productive but more difficult to run and require investments and available land (Sodarak, et al., 2003).

Home gardens for food security and improved nutritional well-being

During 2002-2004, the Government of Lao in collaboration with FAO implemented a novel project that promoted home gardens for improving food security and nutritional well-being among rural communities in 4 selected villages of Central Laos. Models for household and community nutrition garden production including horticulture (variety of vegetables and fruits, including indigenous plants), small livestock and aquaculture production, in combination with nutrition education were developed through technical support for training, technology transfer, extension services, materials and tools. The objective was to establish a model to reduce the severe malnutrition prevalent in rural areas and improve the nutritional well-being of the population by increasing production and consumption of nutritious foods, emphasizing foods rich in micronutrients.

Prior to implementation, some 50% of households in the target villages were involved in home gardening within a limited area. However, the yield and quality of their produce was low due to poor techniques and home garden care. Vegetables were grown in the dry season only, and were unable to meet more than 10-15% of household consumption. The project thus focused on improving the gardens through the use of a net house technique for year-round production of vegetables. This technique stops heavy rainfall from damaging crops, prevents flooding of soil beds, and provides shade from the hot sun. Home gardens were established both on the ground and on table tops, enabling households to grow leafy vegetables throughout the year (Report of the Pilot Project on the Promotion of Home Gardens for Improved Nutritional Well-being, TCP/LAO/2902, FAO and DOA, MAF Report, 2004).

Implications for agro-biodiversity and food security

More than 25 different species of fruit and vegetables were found in the home gardens before the project started. Some of these were local varieties. During the project, additional local varieties were recommended, and farmers were provided with vegetable seeds and fruit saplings. Twenty-three different varieties of vegetables were identified and promoted for their important nutritional qualities, as well as fifteen varieties of fruit and nine types of forest food, including under-exploited

indigenous fruit and nuts (Report of the Pilot Project on the Promotion of Home Gardens for Improved Nutritional Well-being, TCP/LAO/2902, FAO and DOA, MAF Report, 2004).

Not only did the project improve existing traditional home gardens, but it also helped farmers to grow a variety of different leafy vegetables and other crops on a year-round basis with increased yields and improved quality. After one year of project implementation, the area for vegetable production had increased, and the types of vegetables had also become more varied. Before the project started, only 23% of households were growing these vegetables in their gardens, but after the completion of the project, the figure had risen to 75%. Increased home garden production led to a significant reduction in the ratio of vegetables derived from the forest, which decreased by 17%, thereby alleviating the stress on over-harvested forest resources (Report of the Pilot Project on the Promotion of Home Gardens for Improved Nutritional Well-being, TCP/LAO/2902, FAO and DOA, MAF Report, 2004). This is also likely to have a positive impact on time use and labour, reducing the time spent by women, in particular, on gathering these foods from the forest.

As a result of the increased production and access to a larger variety of vegetable crops in the participating villages, the average daily production of vegetables reached 245 grams per person, compared to the present national per capita daily availability of 64.3 grams. The various vegetables grown during the project contain a number of essential nutrients with important nutritional benefits for combating malnutrition. These include Vitamins A, B complex and C, iron, iodine, minerals, fibre and protein.

Other farming systems and related nutrition components

In addition to crop production, other components were also included to enhance food and nutrition security and provide income. The project helped increase farmers' awareness and skills in fish farming techniques. With better management of ponds, fish consumption increased, while improved marketing boosted the sale of fish. Poultry production (chickens and ducks) was also included to enhance animal protein and energy in the protein-deficient diets. This also helped families accumulate income: for a three-month period at the end of the project, each household had an earning of USD 150 from the sale of poultry, after meeting the consumption needs of the household.

Nutrition education and food preparation activities were closely linked to food production. Food preparation demonstrations were offered to the target households to increase the number of foods used in daily meals. This programme managed to improve nutritional practices in a relatively short time. Generally, households consumed leafy vegetables not more than one to three times per week or less, before the project and similar patterns were noted for the consumption of fruit, fish, eggs and meat. After 15 months, the frequency of consumption of leafy vegetables had increased to one to three times per day. The feeding practices for infants and young children were also monitored to address the problem of underweight among children under five. After six months of regular growth monitoring, combined with nutrition education, anthropometric measurements showed that the prevalence of

underweight children was declining. The final measurements in July 2004 recorded a rate of 15.6%, down from 23.2% at the baseline (April 2003). For underweight children 24-35 months old, the prevalence dropped from 33.3% to 5.6% post intervention.

Home garden model for national implementation and links with agro-biodiversity

The FAO project has developed innovative home garden models that integrate agricultural production with nutrition awareness. The results have demonstrated that they can serve to increase food production with optimum use of the available area, diversify food production, increase food supply and availability and meet the food and nutritional needs of household members.

At present, all 204 project-covered households have home gardens within the area they already had, and use their home-grown produce for the nutritional well-being of the family and for extra income. The technical inputs provided were training, extension services and transfer of technology (field demonstrations). A community garden was also established in each target village to serve as a 'model nutrition garden'. These could be considered as national models for larger-scale food production and could be undertaken by households that have larger areas of land.

The intersectoral collaboration (agriculture, health and education, Lao Women's Union) fostered by the project at district and provincial levels could effectively replicate the home gardens on a larger scale. With the input of seeds, fruit tree saplings, fish and frogs, and small livestock, plus nutrition education, home gardens are a cost-effective method of promoting food security and nutrition at household and community levels in poor remote areas of the Lao PDR.

While the project has contributed to enhancing agro-biodiversity and conserving local varieties of fruit and vegetables, the promotion of diversified production has not been systematic and could be further strengthened. The high levels of plant species and genetic diversity found in home gardens are important for *in situ* conservation of a wide range of plant genetic resources, which should be taken into account more systematically in future research and development efforts on home gardens.

The national agricultural biodiversity programme and home gardens

The biodiversity of Lao PDR is globally significant, as it is a mega–diverse country and primary centre of origin and diversity for cultivated rice (*Oryza sativa L.*) and other crops. Over 700 species of wild plants are exploited for food and other uses in Lao PDR and of the more than 1,400 species of wild animals identified in the country, 90% are used in one way or another by the local people. Aquatic life provides another essential protein food source resource, comprising 43% of the total animal food consumption. However, the information base for agricultural biodiversity in Lao PDR is so inadequate that it greatly impairs the use and development of these resources, despite the global importance of the unique diversity that emerges from the convergence of three mega centres - India, China and South East Asia.

A National Agricultural Biodiversity Programme was developed at the beginning of 2004 to support two of the main development priorities for Lao PDR: improved food security and livelihoods for rural communities, and enhanced government capacity to ensure the sustainable use of natural resources (Dyg and Phithiyaphone, 2004). In order to achieve globally agreed commitments to food security and poverty alleviation in the Lao PDR, strategic investments are required. The comprehensive National Agricultural Biodiversity Programme was developed by FAO, UNDP and NAFRI as a framework and long-term strategy for implementing a coordinated approach to better use, development and conservation of agricultural biodiversity (FAO, 2004).

One of the programme's five thematic components is 'household-based integrated agriculture production systems', which the development of home gardens can supply. This component includes three main outputs:

1) *Assessment of the impact of household-based integrated agriculture production systems (home gardens) on the sustainable livelihoods of people*. The FAO home garden project has already documented the benefits of home gardens on nutrition and improved food security on a small scale. The programme also calls for the identification and documentation of indigenous foods and community food systems and their contributions to micronutrients and nutrition in general. So far, there is limited documentation of the nutritional value of indigenous foods.
2) *Expansion and improvement of household-based integrated agriculture production systems in target households to increase the amount and variety of nutritious foods, for example, fruits, vegetables, small animals, fish and other aquatic resources*. This includes training household members and agricultural staff at all levels in household-based integrated agriculture production systems and harvest and post-harvest processing. It also includes provision of seeds, small animals, fish and garden tools and assistance in marketing.
3) *Improved understanding of nutrition:* Planned activities include assessing household awareness of nutritional needs, training extension staff in understanding nutritional needs and developing nutrition education materials. Training on nutrition management and food preparation is also planned for families, while enhanced awareness of nutrition needs and gaps is needed among policy makers.

Implementation of the agro-biodiversity programme could thus build on FAO's home garden project, and expand its activities, geographically and thematically.

Recommendations

Promoting biodiversity and nutrition through home gardens is central to community-based actions leading to food security and nutrition, and the following arguments are offered in support of such actions:

- Home gardens can play a key role in domesticating NTFPs and relocating fallow plants from swidden fields. Therefore, more research and projects should be launched to support the documentation and development of NTFP domestication and the preservation of fallow plants.

- Home gardens can make significant contributions to dietary diversity and the food and nutrition security of rural households. There is a need to upscale the FAO home garden project concept and methodologies, as well as other successful home garden experiences, for replication across other rural areas.
- Agricultural biodiversity considerations should be taken into account when promoting new crops or proposing changes to existing farming systems in newer projects and activities. If agricultural biodiversity concerns are not mainstreamed at the project and policy levels, adverse effects will inevitably result.
- Indigenous foods are important for the food security of many rural households and are likely to contribute micronutrients and other nutritional qualities. However, this needs to be documented and supported through more research. Increasing the limited knowledge of indigenous food nutritional qualities could enable increased promotion and marketing of such products.
- Nutrition education should be an integral component of community development activities, so as to promote increased awareness and consumption of the varied diet required to meet dietary nutrient needs.
- Community networks are needed to monitor nutrition and promote food security, nutrition, health and home economic improvements. Accordingly, as part of community empowerment and capacity building, a critical mass of community members should be organized and trained in rural livelihoods strengthening and nutrition improvement.

Conclusions

The close linkages between biodiversity and food security are evident in the food systems of indigenous peoples and rural home gardens. Home garden farming systems not only ensure household food security and improve nutrition, but also foster conservation, domestication and the development of crops.

Within the broad base of agricultural biodiversity there is an urgent need to adopt measures of diversity that can be used to strengthen and promote food security and nutrition programmes. There is also a need for systematic partnerships between agriculture and nutrition with strengthening of links between nutrition, biodiversity and dietary diversity. This calls for committed interdisciplinary initiatives on biodiversity for food and nutrition, optimizing the use of locally available biodiversity to address problems of malnutrition and assist in the achievement of the MDGs. Policy support that can directly engage collaborative environmental, agricultural, nutrition and health initiatives to promote community level actions for food security and poverty alleviation, continues to be an on-going challenge.

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Abbreviations and Acronyms

CECCT	Child Eye Care Charitable Trust
CINE	Center for Indigenous Peoples' Nutrition and Environment
FAO	Food and Agriculture Organisation of the United Nations
LSUAFRP	Lao-Swedish Upland Agriculture and Forestry Research Programme
NAFRI	National Agriculture and Forestry Research Institute of Laos
NCHS	National Centre for Health Statistics
NTFP	Non-Timber Forest Products
PDR	Peoples' Democratic Republic

ANNEX III

DEBATE FROM SESSION IV: THE WAY FORWARD

Points to be captured in the Draft Recommendations

SESSION IV: THE WAY FORWARD

Interaction between participants – Points to be captured in the Draft Recommendations

Chair: Prof M.S. Swaminathan

This session was designed to examine, discuss and harmonize the draft recommendations developed by a drafting committee and presented at the session. Discussion on the draft led to the unanimous conclusion that further improvement in style, content and language was needed and that this might require additional time beyond the conclusion of the consultation. Hence, the drafting committee was requested to continue its task through e-mail with facilitation from the consultation organizing secretary based at MSSRF. In view of the additional time available for finalizing the recommendations, participants were requested to send additional comments and suggestions electronically to the organizing secretary. It was the common desire of all participants that the revised and finalized recommendations be formulated on the basis of well-pondered inputs from participants. Prof Swaminathan urged participants from the different countries to develop affordable national plans of action relevant to the socio-economic and political conditions in their respective countries, based on the final recommendations.

The final recommendations emerging from this consultation, entitled 'Chennai Platform for Action' are provided in the earlier part of this report, immediately following **Session V**.

The participants' comments and suggestions made during discussion on the draft recommendations are provided below:

- In relation to the opportunity cost of sustainable conservation of biodiversity at the community level, unless and until a mechanism is put in place whereby the community is empowered with resources to conserve, it would not be sustainable. This fact needs to be recognized.
- Suggested opening phrase for text: '*This consultation is convinced that agricultural biodiversity is essential to addressing the challenge of hunger and poverty in the developing countries*'.
- The need for capacity building in various countries at the level of scientists and the community, right down the line, was mentioned throughout the conference. It should also be included in the document.
- Most farmers do not have diverse diets because they cannot afford it. Therefore, the issue of diverse diet may have possible links with better economic means.
- There is a need for multiple strategies to promote awareness and action on the use of biodiversity for reducing poverty and promoting nutrition and health.
- The importance of biodiversity to the removal of hunger and poverty should be emphasized in the opening para of this document. It is the initial reaction that counts.

- The text should indicate that the delivery of the Millennium Development Goals is crucially dependent on national development plans. The role of agriculture in biodiversity should be aptly focused in the recommendations.
- It has been said that the important contribution of agro-biodiversity is not recognized. Not recognized by whom? There are international treaties that recognize the importance of agro-biodiversity. It has not been recognized by the international community!
- The most significant contribution of agricultural biodiversity is to nutrition, health and income.
- With regard to the many crops that can effectively contribute to the nutrition of the poor, frequently missing are the basic extension messages and the technical expertise required. This information must be made accessible to farmers.
- There should be much greater emphasis on resources, showing that they are already in place, even before training the extension workers.
- The draft says *'Enact land use and other policies, including seed policies, farmers' rights and such items.'* It would be useful to make this more specific.
- There is mention of 'international facilitation of access benefit-sharing of genetic resources over a broader range of species.' It is not very clear whether this relates to the enhancement of major crops or if it also takes care of other crops. We should clarify.
- It should be emphasized that vehicles are required to be put in place to enhance the marketing of neglected and under-utilized crops.
- The phrase that speaks of '*sharing of genetic resources of a broader range of species*' needs to be explained. It is known to us, but other readers may wonder what 'a broader range of species' means. Many of these points need to be clearly explained in the text to make it meaningful to a wider spectrum of stakeholders.
- Where it says 'adjust research priority', it would seem more appropriate to say *'incorporate biodiversity in the research priorities'*. Otherwise, it would seem that something has to be changed. We have to be adequately clear here.
- It is important to include the concept of emphasizing community ownership or management of these biodiversity resources**.** Otherwise, the whole community aspect is missing.
- When talking about the communities it is important to mention access to technologies for value addition of the produce, and access to credit and markets.
- It seems that with the emphasis being placed on school feeding programmes only, we are simply targeting schools, and leaving out other vulnerable sectors.
- We should clearly spell out what we are going to do to support the marketing of products produced by small-scale farmers. In discussions we had with the community people, all farmers clearly stated that they need practical support to be provided and linkage to the market.
- The other point concerns literacy in schools and agriculture university curricula. We will have to make national guidelines to take the curricula to schools because agriculture universities may not be found everywhere.

- More cooperation between the private and the public sector would have been desirable to bring in the power of the private sector - in the area of income generation, developing value change, opening markets, etc.
- A suggested first para of the text could be 'Agricultural biodiversity is essential to deliver the Millennium Development Goals of freedom from hunger and poverty. This has not been sufficiently recognized. The Chennai International Consultation urges all levels of society to use agricultural biodiversity to tackle hunger and poverty, which will also promote better health for women and children and can continue to improve lives in a sustainable manner.'
- This declaration focuses on food, health and nutrition. But in Group II, we also discussed the possibility of growth with the potential of biodiversity in non-food items. We talked about bio-fuel, and bio-materials - these are new economic growth areas that many countries are interested in. I think we should also include these items, so as to capture the attention of governments interested in developing new economic growth areas.
- There is one problem that is very crucial from the economic point of view, and is still pending: the issue of intellectual property rights versus farmers' rights. It has not been addressed here, so far.

Prof Swaminathan thanked the drafting committee for their hard work and reminded all present to provide any further inputs they felt appropriate to add to the strength of the final document.

The session was then closed.

ANNEX IV

SESSION V: CLOSING AND WRAP-UP

SESSION V: CLOSING AND WRAP-UP

Chair: Dr E. Frison

Closing Speeches

Dr Frison

I would like, first of all, to thank all the participants for their very active participation in this intense meeting. I think we all recognize that we have squeezed a lot into two days of work. I realize that this has been a very intense period and I would like to thank all of you for your contributions.

This document has the potential for making a great impact. But we have not yet finished our work: there is still a lot to be done, as Professor Swaminathan mentioned. At the national level, we need to make sure that these messages get across, that we use this text as a tool to leverage the interest that will be required. We also need to build the necessary support at the international level and it would be very useful if we can have some champions among the countries represented. I will be calling in particular on the Ministers present here today, to ask if they can be the champions of this declaration and make sure that when their countries are represented in New York in September that they will be carrying that strong message and supporting the initiative at that level.

I would also like to make one additional point. There is a very relevant path, to which our colleague from India also referred: the Convention on Biological Diversity, which has passed a resolution in CoP 7 in Kuala Lumpur on the link between biodiversity and nutrition and health, and thereby the contribution that biodiversity can make to the Millennium Development Goals. This was the result of the keynote address I gave at CoP 7 which stimulated the resolution and later on the discussions in the UN Standing Committee. I understand that, unfortunately, Dr Hamadallah Zedan has left the Convention on Biological Diversity but he is a very strong supporter of our initiative here and he asked me to convey to the participants his support. He is counting very much on all the relevant partners to contribute to this new cross-cutting initiative within the agricultural biodiversity work program of the CBD. This cross-cutting initiative on biodiversity, nutrition and health which we will be leading, together with FAO, and where we count a lot on other partners to join us in supporting this initiative, is very relevant to our discussions here today. I am sure that the Secretariat of the CBD will also support what emerges from this consultation and will help us get it on the agenda of the New York Meeting.

So, I would now like to call on some people to make the closing remarks. I will first of all ask the Honourable Minister from Kenya, Moses Akaranga, to make some final remarks on behalf of the policy makers.

The Hon M. Akaranga

Thank you very much, Mr Chairman. First of all, I take this opportunity to thank the organizers of this workshop. Indeed it came at the right time and on the right subject – the role of biodiversity in the reduction of hunger and poverty. I would say that having attended the workshop I can now speak with a lot of confidence on what biodiversity is all about.

"Mr Chairman, I am happy to mention that we had a mixed group of people with various experiences, including representatives of development partners such as IFAD, policy-makers and ministers, representatives of farmers, the international media and non-governmental organizations. This diversity resulted in a rich exchange of experience. At least the majority of scientists are now able to hear the contributions from the politicians – the Minister from Ghana, the Minister from Sri Lanka, and all of us here benefited from those experiences. But, Mr Chairman, in wrapping-up, let me say that as only a few ministers are present at this meeting, I trust that there will be a way of getting this message to those who did not come. It should be a message for all, because hunger does not choose where to go. Hunger is something which all of us are supposed to fight together.

So, Mr Chairman, what next? What is expected of us when we leave here? There are the declarations that we have put forward but we need to make a commitment as a group, regarding what we are going to do in our areas.

The second question is how do we get those who are absent, to receive the message? I would recommend, Mr Chairman, that funds permitting, we hold regional workshops - for example, in East Africa, West Africa and other parts of the world, so that we start sailing…..

When I reached the workshop, I asked: "Where is the Press?" I was told that the press is not allowed. I replied that whereas you scientists want to do your work in laboratories, we politicians want other people to know what we are doing. I remember the words of Henry Kissinger, who wanted the whole world to eliminate hunger and prevent malnutrition but up to now it has remained nothing more than a wish! Human beings need to be pushed in order to take things seriously. So, we have to make our choice, Mr Chairman: we either support and act on the resolutions adopted in this meeting to enable people to survive or we place these resolutions in a basket and we perish. With these few remarks, I thank you all.

Dr Frison

Thank you very much. I would like now to pass the floor to the second speaker representing Civil Society. I would like to call on Lucy Wangari Mwangi from Kenya.

Ms Lucy Wangari Mwangi

Thank you very much, Mr Chairman. Let me start by saying that civil society, the farmers' organizations and national NGOs are very happy to be represented in this very important consultation, which was actually very fruitful, considering that farmers and civil society have had a chance to sit down and consult with the government and the

donors, the development partners. It is not every day that we have a meeting between civil society and the government. For the recommendations to be implemented, the government will have to come in very strongly because they are the policy makers and it is very important for them to be involved in the consultations.

It was also very good to include the community. We saw this morning that the local community was really involved and their recommendations were incorporated in the 'The Way Forward' in the Action Plan. Decisions are very important because we are trying to eradicate hunger and poverty and the person who is really affected by hunger and poverty in any country is actually the small-scale farmer. Therefore, it is very important to have the farmers represented. Also, when you are coming up with the policy, it is good to have the farmers' voice included because it is the farmer who is actually going to implement what we recommend.

I also wish to thank the M.S. Swaminathan Research Foundation for including the community. I hope that when we incorporate all that we have recommended here, with all our involvement, the outcome will be excellent. I also thank MSSRF for inviting NGOs and farmer organizations to this consultation and for incorporating their views in the recommendations.

Thank you all very much.

Dr Frison

I would now like to call on Dr Andrew Bennett, as a representative of the donors.

Dr Andrew Bennett

First of all, there are many people to thank! Thank you, Prof Swaminathan and the M.S. Swaminathan Research Foundation, together with IPGRI, for having this idea of bringing us together. Often when you have an idea, it takes quite a lot of effort to make sure to get the right people to the table. We are delighted to have been part of that process.

I think we all believe passionately in the role that biodiversity can play now and in the future to increase opportunities, options and choice. But we can't underestimate the challenge that we have of getting what we have talked about today onto an agenda that will ultimately make a difference. The more I work in the field of natural resources and the environment, the more I realize that people who had passions in the past that created organizations, treaties, agreements, institutions – have all focused on a particular issue. They all relate very much to the way we live on the land we are in, the water we use and the air we breathe. And what I think is the hardest part is that when targets were set for the Millennium Development Goals there were a lot of things left out. And the difficulty now is how to get them back on the agenda in the right place.

I think what we tried to do yesterday and today is to talk more about the relevance of biodiversity and the contribution it can play - in other words, to show people that we have got something to offer. We are not just asking for money for a cause, or to be heard, we have actually got something we can contribute. We have got to strike a nice balance between wanting things done for us and doing what we can do to contribute to helping other people achieve their agenda.

Just in conclusion, I think this is a valuable meeting. It was a meeting that challenged us to ask ourselves what can we offer; are we relevant, and what can we contribute. And I hope that we can build on what we have got – but, as others have said, it doesn't stop here.

Once again, I want to thank the organizers. A particular 'thank you' to Dr Bala Ravi for all his hard work. Thank you all for your gentle persistence and for all your help.

Dr Frison

Thank you. And for closing remarks, I would like now to call on the representative of the media, Subramanian Vincent.

Mr Subramanian Vincent

I will keep this very short. One of the opening problems that we actually talked about yesterday was how we can take this kind of discussion from these rooms out into the public and get the general message about biodiversity more accepted in public – in regional media, English media and so on.

As a media person, what I see is that, as rich as biodiversity is, there is also a richness of stories for the media in the Indian topic. And the way media people tend to see things is 'what are the stories to tell?' It is not the best thing to talk directly to media people, saying 'you guys should run more stories on biodiversity: this is biodiversity and this is what it is all about'. That doesn't actually work except with very particularly-focused media people. What could happen is this: you have got the story on biodiversity and health; you have got the story on biodiversity and nutrition; you have got the story on biodiversity and income; you have got stories on biodiversity and drought proofing; you have got stories on biodiversity and basic conservation. Each of these themes are examples in themselves. So, if journalists can just have stories to tell – which, incidentally, are biodiversity stories - then you will automatically see that the public is actually getting to know of them, and you will see some improvement. Also, the breakdown of biodiversity coverage into individual stories allows room for coverage over a long period of time in smaller stories, as opposed to just one blast to the media with a whole bunch of press releases. That sort of continuous coverage is also important. I will stop here.

Mr Deepak Pawar Yogesh

Agreeing with his colleague, Mr Subramanian Vincent, Mr Pawar added "The space available in newspapers and magazines for development issues is gradually shrinking. In fact, very few newspapers or television channels in India have a staffer to cover agriculture. A single large story on biodiversity in the media is not practical. But the media would be interested in taking up individual case studies or success stories on biodiversity or problems caused by lack of biodiversity. Some time ago, UNDP brought out a booklet on the 100 greatest success stories in development sponsored by them and the World Bank brought out a publication which is available on the internet on the 50 greatest communication stories in development. Now, if we could have 100 or even 50 stories on biodiversity, that would be a piece of literature

that everyone would treasure and it would do more to communicate and promote biodiversity, and be more effective maybe, than conferences like this."

Dr Lalitha Bhattacharjee

I am speaking from a very recent experience: an international conference related to biodiversity held in New Delhi. It involved what were called the 'mega-diverse' countries of Latin America, Africa and Asia who brought out a draft recommendation in Delhi last month. Also attending was the editor of a leading national daily, who just didn't like the word 'mega-diversity'. He said it didn't make sense to him and wouldn't to a lot of people, no matter how important the topic might be. So, somehow, in addition to the stories, we need to have a slightly flexible mindset on how we are describing these problems to the lay audience. We should be careful not to get fixed on a particular term or a way of representing it which may be technically accurate, because for larger audience we may just have to use a more common or flexible terminology.

Dr Frison

Thank you. I just want to add a few personal words of thanks. Thanks have been expressed to everybody just now, but I personally want to thank Professor Swaminathan for the collaboration we have had in this whole initiative. The original planning started about a year ago and it has been a wonderful experience of working together. I am very happy that we have made this a success and I want to thank you personally for your inputs all through the year that we have been together.

Prof M.S. Swaminathan

Prof Swaminathan thanked the group and invited them to join him for refreshments. "I personally will miss being with you this evening because I have to leave for Rome – to attend a meeting at IFAD. Once again I want to thank Emile Frison and all his colleagues and also send good wishes to Stefano Padulosi who unfortunately has not been able to be with us. Please convey our good wishes to him. Thank you all very much."

Dr Frison

With that we come to the end of this meeting. I will call on the Executive Director of the M.S. Swaminathan Research Foundation to pass the Vote of Thanks.

Vote of Thanks

Dr M. Velayutham, Executive Director, MSSRF

Respected Chairman, ladies and gentlemen, we have had two days of intense discussion – an International Consultation on the Role of Biodiversity in achieving the UN Millennium Development Goal with regard to hunger and poverty – and deliberation, the essence of which has come in the form of draft recommendations.

It has been a pleasure for the M.S. Swaminathan Research Foundation, along with the International Plant Genetic Resources Institute and the Global Facilitation Unit for Underutilized Species, to have organized this timely international consultation.

Our grateful thanks and appreciation for the partnership that these two organizations provided to MSSRF. The five sponsors to this conference need a special word of thanks and our gratitude, namely, the International Fund for Agricultural Development, the Canadian International Development Agency, the Swiss Agency for Development and Cooperation, SYNGENTA and the Ford Foundation.

The very start of the consultation was graced by four Honourable Ministers - from Sri Lanka, Kenya and Nigeria and from the local Tamil Nadu State Government. Our grateful thanks to them for having given the prominence of their presence.

We are grateful to the very different lead speakers in the different sessions, the chairpersons, the rapporteurs of the various technical sessions and the working groups and members of the drafting committee. The Hindu Media Resource Centre organized the public forum. We are grateful to Mr Ravi, Editor of the Hindu, who chaired yesterday evening's program and a host of press and media people who attended and covered the two days' deliberations as well as those who participated in the public forum.

The distinguished participants have come from India and from 20 other countries. About 100 people! I cannot thank them individually but am thanking them collectively. You received a very warm reception yesterday and heartfelt thanks are being extended to you all right now.

Several other organizations were invited but could not manage to be here and they will be looking forward to the September event of the UN Assembly. As our Chairman said, these draft committee recommendations will be the starting point for the next week in which we need your continued inputs.

The self-help group members with whom you interacted directly have provided what I can say to be the nuclei for all the members of this august house.

Finally, I thank our Chairman, Professor Swaminathan. He is the brain behind the conception and realization of this entire consultation process. In fact, this subject is very dear to him and he always remarks that "We human beings are guests of the flora and fauna biodiversity in the world." And he has taken to its logical conclusion the idea of bringing it to the attention of the UN Assembly at the forthcoming meeting in September, to make due demands for the investment, public action and policies it deserves, for the conservation and enhancement of biodiversity on our planet. Thank you very much.

AGENDA FOR THE CONSULTATION

Sunday, 17 April 2005

Arrival of participants and registration
19.00 Reception and dinner

Monday, 18 April 2005

08.30 – 09.30 Registration of delegates (MSSRF)

09.30 – 11.00 Inaugural session
Chair: Prof M.S. Swaminathan, Chairman, National Commission on Farmers

Invocation	Anuradha Krishnamurthi
Welcome addresses	M. Velayutham, Executive Director, MSSRF
	K. Atta-Krah, Deputy Director General (appointed), IPGRI
	O. Smith, Executive Secretary, GFAR
Presidential address	Biodiversity and MDGs
	Prof M.S. Swaminathan
Special address	Agricultural biodiversity and livelihoods
	E. Frison, Director General, IPGRI
Keynote addresses	R.D. Cooke, Director, Technical Advisory Division, IFAD
	Hon K. Pandurangan, Minister of Agriculture, Tamil Nadu
Inaugural address	Hon E. Debrah, Minister of Food and Agriculture, Ghana
Vote of thanks	S. Bala Ravi, Consultation Organizing Secretary, MSSRF
11.00 – 11.20	*Coffee break*

11.20 – 13.00 Session I – Biodiversity and livelihoods
Chair: Hon E. Debrah, Minister of Food and Agriculture, Ghana
Rapporteurs: FARA, Syngenta Foundation

11.20 – 11.40	Diversity, nutrition and food security: the case of African leafy vegetables	R. Oniang'o (Kenya)
11.40 – 12.00	Asian tropical fruits deliver social and economic benefits	K. Tahir (Malaysia)
12.00 – 12.20	Andean grains and tubers: ancient crops for better livelihoods today	J. Blajos Kraljevic (Bolivia)
12.20 – 13.00	Discussion	
13.10 – 14.15	*Lunch break*	

14.15 – 15.45 Session I (continued)
Chair: H.P.M. Gunasena, Executive Director, Council for Agricultural Research Policy
Rapporteurs: GFAR, FAO

14.15 – 14.35	Managing biodiversity for improved community well-being	S. Sastrapradja (Indonesia)
14.35 – 14.55	The Market Map: a framework for linking farmers to markets	A. Rob (Bangladesh)
14.55 – 15.30	Discussion	
15.30 – 16.15	*Coffee break and interaction with women self help groups from India*	

16.15 – 17.45 Session II – Biodiversity and policies
Chair: Hon M. Akaranga, Assistant Minister of Agriculture, Kenya
Rapporteurs: APAARI, IFAD

16.15 – 16.35	International policies dealing with biodiversity and their impact on achieving the Millenium Development Goals	M. Hermann (Colombia)
16.35 – 16.55	Marketing biodiversity and benefit-sharing: a product development perspective	N.P. Louwaars (The Netherlands)
16.55 – 17.05	Indian legislation on biodiversity	M.S. Swaminathan (India)
17.05 – 17.45	Discussion	
18.15 – 19.45	Public Forum	Hindu Media Resource Centre
20.00 – 22.00	*Dinner*	

Tuesday, 19 April 2005

09.00 – 13.30 Session III – Group discussions and input to recommendations
Chair: M.S. Swaminathan, Chairman, MSSRF
Rapporteurs: MSSRF, IPGRI, GFU

09.00 – 10.30 *Group 1: Food and nutrition security*
Chair: J. Jaftha, Senior Manager, Department of Agriculture, South Africa
Group 2: Biodiversity and socio-economics
Chair: K. Atta-Krah, Deputy Director General (appointed), IPGRI
Group 3: Policies
Chair: N.P. Louwaars, Senior Scientist Biopolicies, CGN, WUR, The Netherlands
Group 4: Community perspective
Chair: M. Velayutham, Executive Director, MSSRF

10.30 – 11.00	*Coffee break*	
11.00 – 12.00	Report to plenary	Group Chairs
12.00 – 13.30	Preparation of draft recommendations	Drafting Committee
	Visit to MSSRF	
13.30 – 14.30	*Lunch break*	

14.30 – 16.15 Session IV – The way forward
Chair: M.S. Swaminathan, Chairman, MSSRF
Rapporteurs: FAO, GTZ

14.30 – 15.15	Presentation of draft recommendations	Chair, Drafting Committee
15.15 – 16.15	Adoption of recommendations	
16.15 – 16.45	*Coffee break*	

16.45 – 17.45 Closing and wrap-up session
Chair: E. Frison, Director General, IPGRI

16.45 – 17.30	Closing remarks	Policy makers, donors, civil society organizations, media, organizers
17.30 – 17.45	Vote of thanks	Executive Director, MSSRF
19.30 – 21.30	*Cultural programme and farewell dinner*	

Wednesday, 20 April 2005

Departure of participants

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