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Australian Centre for International Agricultural Research

REPORT

FAO Regional Initiative on Zero Hunger Challenge

Regional Expert Consultation on Scoping, Prioritizing and Mapping of Neglected and Underutilized Crop Species in Asia

3-5 December 2016

Royal Princess Hotel Larn Luang

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Acknowledgements

Under the strategic guidance of Kundhavi Kadiresan, ADG/RR, RAP, with the strong support from the RAP senior managements and collective efforts from both Headquarters, RAP and concerned FAORs, the Regional Expert Consultation on Scoping, Prioritizing and Mapping of Neglected and Underutilized Crop Species in Asia, under the RAP Regional Initiative on Zero Hunger Challenge, in observance of International Year of Pulses was successfully held in Bangkok on 3-5 December 2016.

The Consultation was co-organized by FAO and the Australian Centre for International Agricultural Research (ACIAR) under the Australian Government, in collaboration with the FAO Special Ambassador of the International Year of Pulses 2016, the University of Western Australia, the International Centre for Agricultural Research in the Dry Areas, the International Crops Research Institute for the Semi-Arid Tropics, Bioversity International, the M S Swaminathan Research Foundation - Leveraging Agriculture for Nutrition in South Asia, Mahidol University, the Chinese Academy of Tropical Agricultural Sciences - Tropical Crops Genetic Resources Institute, the International Centre for Integrated Mountain Development, Crops for the Future, the International Tropical Fruits Network, and The Akshaya Patra Foundation.

I would like to take this opportunity to express sincere appreciations to all colleagues who provided helpful support to the successful organization of the Consultation, especially FAORs who have been playing a main role in coordinating with national governments on country representative nomination for the preparation of country studies ahead of schedule. I sincerely thank SP1 and SP2 colleagues in Headquarters and RAP, who made technical contributions, provided partnership, communication and further support to the Consultation. At this point, I would like to thank Karel Callens, Yongfan Piao, Sumiter Broca, Patrick Durst, Nomindelger Bayasgalanbat, Amgalan Ariunbold, Kenichi Shono, Gerard Sylvester, Benoist Veillerette, Egle DeAngelis, Kaori Abe, Allan Dow and Sakun Gajurel. My special appreciations go to Xiangjun Yao who provided strong support to the preparation, and encouraged the partnership-building and South-South Cooperation for the Consultation. I want to thank Isabell Piroth for her excellent support throughout the preparation of the Consultation. I also want to thank the administrative support from the RAP office, Yowanat Voratira, and APRACA, Thanawan Ampaipanvijit and her team, for their excellent and smooth organization of the event especially during the long three-day weekend including a national holiday in Thailand.

Dr Xuan Li

Senior Policy Officer
SO1 Focal Point and Delivery Manager for RI-ZHC
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List of Acronyms

ACIAR	Australian Centre for International Agricultural Research
ADG/RR	Assistant Director-General and Regional Representative
BARI	Bangladesh Agriculture Research Institute
BI	Bioversity International
CARDI	Cambodian Agricultural Research and Development Institute
CATAS-TCGRI	Chinese Academy of Tropical Agricultural Sciences- Tropical Crops Genetic Resources Institute
CEO	Chief Executive Officer
CFF	Crops for the Future
CoRRB	Council for Renewable Natural Resources Research of Bhutan
DAR	Department of Agricultural Research, Myanmar
DoA	Department of Agriculture, Bhutan
FAO	Food and Agriculture Organization of the United Nations
FSF	Future Smart Food
GDP	Gross Domestic Product
GI	Geoinformatics
GIS	Geographic Information System
ICARDA	International Centre for Agricultural Research in the Dry Areas
ICIMOD	International Centre for Integrated Mountain Development
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IYP	International Year of Pulses
MoAD	Ministry of Agricultural Development, Nepal
MoAF	Ministry of Agriculture and Forestry, Lao PDR
MoALI	Ministry of Agriculture, Livestock and Irrigation, Myanmar
MSSRF-LANSA	M S Swaminathan Research Foundation - Leveraging Agriculture for Nutrition in South Asia
NAFRI	National Agriculture and Forestry Research Institute, Lao PDR
NARC	Nepal Agriculture Research Council
NGO	Non-governmental organization
NUS	Neglected and Underutilized Species
PRC	Plant Resources Centre, Vietnam
Q&A	Questions and Answers
RAP	Regional Office for Asia and the Pacific
R&D	Research and Development
RSPC	Regional Strategic Programmes Coordinator
SDGs	Sustainable Development Goals

TCGRI	Tropical Crops Genetic Resources Institute
TFNet	International Tropical Fruits Network
UBKV	Uttar Banga Krishi Viswavidyalaya, West Bengal
UWA	The University of Western Australia, Australia
RI-ZHC	Regional Initiative on Zero Hunger Challenge

Executive Summary

The Regional Expert Consultation on Scoping, Prioritizing and Mapping of Neglected and Underutilized Crop Species by the Food and Agriculture Organization of the United Nations (FAO), under the Regional Initiative on Zero Hunger Challenge and in observance of the International Year of Pulses 2016, was successfully held on 3-5 December 2016 in Bangkok.

The purpose of the Consultation was to conduct an interdisciplinary priority-setting exercise on Neglected and Underutilized Crop Species (NUS) for countries, aiming at identifying promising crops that are nutrition-dense, climate resilient, economically sustainable, locally available and culturally acceptable, and provide strategic advice to decision-makers. Thirty-five participants, representing eight countries, including national focal points on Zero Hunger Challenge, as well as twenty-one national and international partners attended this Regional Expert Consultation.

The Consultation was opened by Dr Kundhavi Kadiresan, ADG/RR, RAP. Dr Mahmoud Solh, ex-Director-General, ICARDA/CGIAR, and Prof Kadambot Siddique, FAO Special Ambassador IYP 2016, UWA delivered keynote speeches. Eight thematic presentations covering were presented. Eight country studies prepared ahead of schedule and reviewed by international experts from nutrition, agriculture, ecologic and socio-economic dimensions prior to the Consultation were presented and validated. Two Roundtables were held during the Consultations: one is on "Strategies to Create Enabling Environment to Tap Potentials of NUS to Address Malnutrition: A Policy Perspective"; and the other is on "Strategies to Expand Utilization and Promotion of NUS to Address Malnutrition in the Region: A Technical Perspective".

The Consultation was convened to take forward the recommendations of the Rome Declaration on Nutrition from the Second International Conference on Nutrition (ICN2) in 2014, in order to lay a concrete foundation for food-based approaches at country level that would help achieve the Sustainable Development Goals (SDGs). The background of the Consultation is that hunger, food insecurity and malnutrition are major challenges of the 21st Century in Asia and the Pacific region. To achieve zero hunger, which stands at the core of the SDGs, we need to improve dietary patterns and food systems. Stakeholders along the agriculture and food value chain are affected by a disconnect between production, consumption and knowledge about nutrition, which result in a poor overall nutrition status among millions of people. Agricultural diversification and resilience offer enormous opportunities in addressing hunger and malnutrition in the context of climate change. In this regard, Neglected and Underutilized Crop Species (NUS) provide diverse and nutritious food resources. They are an essential source of protein and micronutrients, enhance climate resilience, and boost household income and livelihoods.

The major outputs of the Consultation include eight draft country studies on NUS, and Recommendations prepared by experts collectively. The Recommendations address, among others, enhancing of public awareness and education on malnutrition and climate change, the renaming of NUS into "Future Smart Food (FSF)", a need for national strategic and inter-ministerial coordination, FSF value chain development, as well as the call for a regionally coordinated FSF network.

I. Background

Hunger, food insecurity and malnutrition are major problems in Asia and the Pacific region. In 2014, around 490 million people are still undernourished in Asia and the Pacific (62 percent of the world's total), out of which 281 million in the Southern Asia sub-region. It is estimated that 93 million children under age of five are still stunted in the region, out of which 68 million are in the Southern Asia sub-region. The micronutrient deficiencies remain widespread in many countries in South-East Asia and South Asia.

Agriculture and nutrition are intrinsically linked. Most people in developing countries rely on agriculture for their employment, income and livelihoods. Poorly nourished people tend to lack the physical capacity to expand the agriculture production; poor households lack sufficient income access to adequate quantity and quality of diversified food to meet nutritional requirement. To achieve the overarching goal of reducing hunger and malnutrition, it is necessary to coordinate and integrate agriculture and nutrition actions to maximize impact. There is a need for better linkages between production, consumption and nutrition to tackle malnutrition and its causes. Dietary diversification is a cost-effective, affordable and sustainable means of strengthening local food systems and reducing hunger and malnutrition.

Recognizing the complex range of factors that contribute to hunger and malnutrition, recent reviews have also called attention to the need to focus on multi-sectoral approach to addressing malnutrition and to ensure that the agriculture production strategies lead to improving and diversifying diets through production diversification and promoting crops that have better nutritional qualities.

Agrobiodiversity offers huge potentials in addressing malnutrition and agricultural sustainability. Globally, approximately 30,000 edible plant species have been identified, of which more than 7,000 crop species have been used for food in the history of humanity. However, only 150 crop species are commercially cultivated and, of these, just 103 crops provide up to 90 percent of the calories in the human diet. Rice, wheat, maize and potato alone account for 60 percent of human energy supply. Furthermore, an ever increasing loss of biodiversity threatens the strength of our global ecosystems.

Neglected and Underutilized Species (NUS) are rich in Asia. They represent a promising abundance of food resources and constitute the bedrock of the food system diversity. Crops among NUS have many benefits and offers huge potentials. As an essential source of vitamins, micronutrients and protein, their nutritional value is high and may thus contribute to attain food security in the region. Besides nutrition value, they contain considerable commercial potentials and therefore contribute to household income generation and livelihood improvements. Furthermore, NUS crops contribute to climate-resilient and more sustainable food systems as they are frequently adapted to marginal conditions. A wider use of today's minor NUS crops may therefore make a great contribution to address malnutrition.

However, it is yet to scope the availability of crop-related NUS, prioritize and identify NUS with high potentials, and map the selected NUS for further development.

II. About the Regional Expert Consultation

The Regional Expert Consultation on Scoping, Prioritizing and Mapping of Neglected and Underutilized Crop Species by the Food and Agriculture Organization of the United Nations (FAO), under the Regional Initiative on Zero Hunger Challenge and in observance of the International Year of Pulses 2016, was held on 3-5 December 2016 in Bangkok.

The objectives of the Consultation were to:

a) Validate Preliminary Scoping Reports on crop-related NUS in selected countries;

b) Rank and prioritize high-potential NUS based on established priority criteria;

c) Identify 5-6 crop-related NUS per country;

d) Strategize to enhance production and utilization of the selected crops in local diets.

The Consultation covered eight countries in both Southeast and South Asia (Cambodia, Lao PDR, Myanmar, Vietnam, Nepal, Bangladesh, Bhutan and West Bengal in India). For the preliminary scoping of NUS, five food groups were relevant, including cereal, roots and tubers, nuts and pulses, horticultural crops and others (e.g. oil seeds and spices). Applying an interdisciplinary methodology, the crops were assessed from nutrition, production, ecological and socio-economic perspectives. As part of a three-stage priority-setting exercise, the Expert Consultation represented stage two, encompassing the abovementioned objectives. The first step had been a preliminary scoping of the availability and use of NUS in each of the eight countries and the preparation of eight national/State studies, which were subsequently reviewed by international partners from various fields. These partners had been identified in a process of partnership and team building in October 2016. In a consecutive step after the Consultation (starting from January 2017), preliminary scoping studies will be revised according to the outcomes and suggestions during the meeting, peer-reviewed and shared with governments for further discussions at national level. Other follow-up activities will be the geographical mapping of NUS in selected countries, as well as the development of recommendations for policy makers and value chain assessment to create an enabling environment for NUS.

The participants of the Consultation included national focal points on ZHC, national research partners from all eight countries, international research partners, one non-governmental organization (NGO), as well as FAO. International research partners covered four different disciplines (nutrition, agriculture, ecology and socio-economic) as well as expertise in Geoinformatics (GI) technology. Responsible for the review of Southeast Asian countries from an agriculture/ecological perspective were the Chinese Academy of Tropical Agricultural Sciences- Tropical Crops Genetic Resources Institute (TCGRI-CATAS) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Bioversity International (BI) reviewed studies in both regions, with support from the International Centre for Agricultural Research in the Dry Areas (ICARDA) in South Asia. Review from a nutritional point of view was conducted by Mahidol University in Southeast Asia and, in South Asia, by the M S Swaminathan Research Foundation - Leveraging Agriculture for Nutrition in South Asia (MSSRF-LANSA). Socio-economic parameters were reviewed by Crops for the Future (CFF) in Southeast Asia and the International Centre for Integrated Mountain Development (ICIMOD) in South Asian countries. The three-day meeting covered five technical sessions as well as two roundtables on both policy and technical perspectives.

III. Sessions

A. Opening Session

The Consultation was opened by **Dr Kundhavi Kadiresan**, Assistant Director-General and Regional Representative of the FAO Regional Office for Asia and the Pacific. She thanked the FAO Special Ambassador for the International Year of Pulses 2016 (IYP), Dr Mahmoud Solh as well as all experts and senior officials from various governments for their attendance and welcomed all participants. She highlighted the current status on global hunger and malnutrition, and emphasized the consequential work that still lies ahead of us. In order to change improve the status quo, dietary patterns and food systems need to be changed. Gaps in the system need to be identified and production, consumption and nutrition more closely linked. One major factor is the current focus on a few staple crops, which limit dietary as well as production diversity. Although a significant amount of other diverse and nutritious foods are known, they remain neglected and/or underutilized. To address all forms of malnutrition, including both under- and overnutrition, Neglected and Underutilized Crop Species (NUS) show great potential. They are also beneficial to the environment and can diversify agricultural value chains. In light of the International Year of Pulses 2016, Ms Kadiresan underlined the potential and importance of pulses within NUS. For the Consultation, she urged everybody to think about and find the way forward, rather than only discussing present issues. She pointed out that in order break the vicious cycle of malnutrition, to improve diets and diversify agricultural production, Government policies, such as subsidy schemes, and country-specific programmes are essential. She also highlighted that available data needs to be made public to raise awareness and change the behaviour and knowledge of consumers and other stakeholders as well. Ms Kadiresan was impressed by the contributions and efforts made by national experts in advance of the Consultation and expressed her anticipation in view of the discussions and outcomes of the meeting. Her full speech can be found in Annex 4.

Dr Xuan Li, Senior Policy Officer and Delivery Manager of the Regional Zero Hunger Challenge (RI-ZHC) Initiative in FAO RAP, gave a brief on the proceedings, objectives and expected outcome of the Consultation. At first, she highlighted the objectives of the Consultation. The Consultation covered eight countries in both Southeast and South Asia. For the preliminary scoping of NUS, five food groups were relevant, including cereal, roots and tubers, nuts and pulses, horticultural crops and others. Dr Li emphasized the interdisciplinary of the applied methodology, covering nutrition, production, ecological and socio-economic perspectives. As part of a three-stage priority-setting exercise, the Expert Consultation represented stage two (Figure 1). The first step had been a preliminary scoping of the availability and use of NUS in each of the eight

countries and the preparation of eight national/State studies, which were subsequently reviewed by international partners from various fields. These partners had been identified in a process of partnership and team building in October 2016. After the Consultation, preliminary scoping studies will be revised according to the outcomes and suggestions during the meeting, peer-reviewed and shared with governments for further discussions at national level. Dr Li also listed some other follow-up activities, such as geographical mapping of NUS, the development of recommendations for policy makers and value chain assessment to create an enabling environment for NUS.

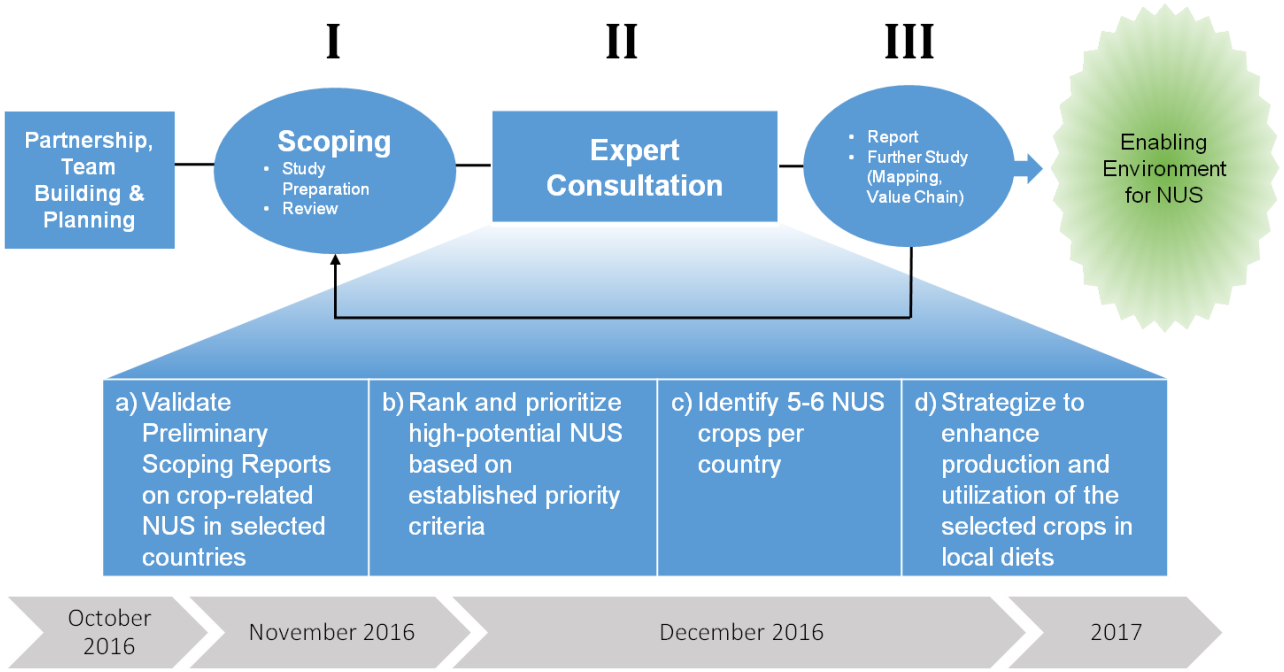

Figure 1: Process of the Three-stage Priority-setting Exercise

The participants of the Consultation included national focal points on ZHC in Lao PDR, Myanmar and Nepal, national research partners from all eight countries, international research partners, one NGO, as well as FAO. International research partners covered four different, as well as expertise in GI technology. Dr Li described the review process of preliminary scoping studies on NUS, which was conducted by international experts from TCGRI-CATAS, ICRISAT, BI, ICARDA, MSSRF-LANSA, CFF, and ICIMOD. She also gave an overview of the agenda for the three-day meeting, covering five technical sessions as well as two roundtables on both policy and technical perspectives.

The brief was followed by a short self-introduction by all participants. The names, positions and affiliations of all participants are listed in Annex 5.

After the brief and introduction round, Dr Li gave a presentation on the "Conceptualization on tapping potentials of NUS to address hunger and malnutrition: linking production diversity, dietary diversity and malnutrition". She gave an overview on the status and the different types of malnutrition in the Asia and Pacific region. Stunting, wasting and underweight are still high in many countries in the region, while overweight and obesity are on the rise as well. Another area of concern are micronutrient deficiencies, especially in iron, zinc, vitamin A and iodine. These are the results of low dietary diversity, which is mainly caused by an overreliance on very few cereals, mainly rice. In Cambodia,

Lao PDR, Myanmar and Nepal, daily cereal intake ranges between 67-81 percent of total per capita food supply, while consumption of fruits and vegetables remains below the daily recommended intake. Adding up to this, is low production diversity in these countries. For a long time, agricultural policies have been in favour of staple and cash crop production, as intensification of single-crop systems was able to achieve higher yields. The focus lay mainly on hunger reduction by increased production of staples, overlooking the fact that micronutrient deficiencies are a serious concern as well. So the challenge is a disconnection between malnutrition, dietary diversity and production diversity which can only be tackled by a holistic and cost-effective intervention that addresses all of these issues. NUS can play a big part in this regard. In Asia and the Pacific, about one third of the cultivated underutilized species are each found in the group of fruits (34 percent) and vegetables (27 percent). Other promising food groups are roots and tubers, nuts, pseudo-cereals and millets, and pulses. NUS are diverse in Asia; many have a high nutrient content and are an essential source of micronutrients and supplementary protein. They are often adapted to marginal conditions and feature high commercial value. Compared to rice, pulses such as chickpea, mung and lupine beans contain four times the amount of iron found in rice. Even in a short intervention period of 60 days, results in terms of haemoglobin increase (an indicator for anaemia) have been observed. Despite their high potential, NUS face several technical as well as policy constraints, including low investment by farmers, researchers and policy makers, lack of sufficient production knowledge and limited policy and market support. More high-potential NUS need to be identified and promoted, and their potential needs to be tapped by all stakeholders along the agriculture and food value chains in the region. At the end, Dr Li gave an outlook on how to bring NUS to scale. To create an enabling environment for NUS, policies, agro-technical investment, institutional support as well as awareness raising need to be enhanced. She implied the need for targeted policy, regulatory, institutional and technical analysis as well as assessment of value chains for prioritized NUS. In order to scope their availability and potential, mapping of NUS via GI technology is projected for further development.

In his keynote speech, **Dr Mahmoud Solh**, Former ICARDA Director General, addressed the “Importance, Challenges and Potential of Neglected and Underutilized Crops”. In light of 810 million people remaining hungry globally, he highlighted the importance and relevance of the Regional Expert Consultation on NUS. He pointed out that NUS are usually grown in their centres of origin, but that awareness about their great potential is increasing. In order to address present challenges, staple crops are not the solution. In this regard, the biggest constraint in terms of scaling up NUS is the business aspect. If people do not earn sufficient money by producing NUS, they will simply not produce them. A vast array of species is available nowadays, to which the focus should come back. He listed examples such as kiwi and quinoa, which have once been underutilized and are now highly promoted and commercialised. It will be important to preserve germplasm and map the availability of NUS in distinct geographical and ecological areas. Traditional knowledge will help to identify potential utilization of NUS, which is an important factor for promoting their production and consumption. In terms of production patterns, technical know-how on multiplication, pests and diseases has to be assessed to understand

why farmers are turning away or towards certain crops. Once these constraints have been identified, policy and legal aspects have to be considered. Research needs a priority-setting to refocus on desirable traits to support production in the long run for the development of sustainable value chains. These traits include tolerance to certain climate-induced stresses, resistance to pests and diseases, nitrogen-fixation abilities and increased water-use efficiency. He gave examples of specific NUS that have evolved in the past based on trait selection and commercial potential, such as quinoa, lentil and grass pea. At the end of his presentation, he underlined the importance of NUS in fragile ecosystems and expressed his hope to come up with clear recommendations that focus on specific crops in selected regions.

The keynote speech by **Prof Kadambot Siddique,** FAO Special Ambassador IYP, Hackett Professor of the Agriculture Chair and Director of The University of Western Australia's Institute of Agriculture, focused on the contribution of pulses to production and dietary diversity to eradicate hunger and malnutrition. He stated that the International Year of Pulses 2016 has been timely and listed its major objectives, which are, among others, to promote the value and utilization of pulses throughout the food system, raise awareness about their benefits, foster enhanced research, advocate for better utilization of pulses in crop rotations, and address challenges in trade. He stressed that pulses are a nutritious crop for the future and besides, can serve multiple purposes, such as animal feed and soil improvement. He also noted that pulses are a potential health food, reducing risks of chronic diseases, obesity and dementia, as well as promoting beneficial bacteria in the gut and featuring anti-inflammatory properties. The best selling points for NUS though are their ability to fixate nitrogen, as well as a low carbon and water footprint. Pulses are produced in all parts of the world and are a global commodity – not only for rural, but also for city people. Nevertheless, pulses have not yet been very responsive to agronomic up-scaling, which would require a more targeted approach. In terms of pulse production, Southeast Asia is the fastest growing region. Global demand is increasing, but at the same time, per capita consumption is decreasing due to population growth. Prof Siddique pointed out several trends, such as a rise in vegetable oil consumption, which usually correlates with rising incomes ("frying power"), and a shift from rice-based diets to wheat products. Compared to cereals, global pulse yields are quite low, due to limited interest and investment, and vary between countries and region. Prof Siddique emphasized that the current yield gap is the biggest challenge for pulses. From this point of view, he raised the question: What are potential incentives to further promote pulses? His answer was to translate lessons learned to success stories to be shared and distributed among policy makers, farmers, consumers and other relevant stakeholders. He touched on one success story with pigeon pea in Tanzania, fostering women participation. With strong support from partners and donors, they introduced high yielding and wilt resistant varieties, being complemented by policies towards quality seed development and the involvement of millers and traders for value addition. He also highlighted the benefits of planting pulses in rice fallow, which was successfully introduced in Nepal, Bangladesh and India. Another approach has been relay-planting in rice-based systems, for which a participatory approach and promotion of genetically

improved varieties are essential. Since farmers are usually resource-poor, research should be enhanced in the direction of reducing unit costs. It is important to keep in mind that global pulse supply currently does not meet global demand. In terms of self-sufficiency, many countries are lagging behind. A combination of new technology, partnership, government policies and the creation of an enabling market environment will be the main drivers for the success of pulses in the future.

During the Q&A session, several topics were revisited. It was emphasized that production is driven by demand and that trade and marketing are very important for further promotion of both pulses and NUS. In this regard, the status and dynamics of consumption patterns, as well as other cultural and socio-economic factors, need to be well-understood. Dr Solh highlighted a case from Ethiopia, where demand-driven lentil production shifted the country from importing to exporting of lentils, leaving farmers with higher incomes and improved livelihoods. In other cases, government support can be beneficial in form of subsidies and minimum support prices for selected crops. It was discussed what the term NUS actually means and if there is a difference between neglected crops and underutilized crops. In Africa, for instance, cassava may be a staple crop. In Southeast Asia in turn, it is available, but has been underutilized. Furthermore, we need to well argue for the expansion of NUS in agricultural production. (Why do we use NUS? To diversify agriculture. Why do we need to diversify agriculture? To achieve nutritional security. Why do we need nutritional security? To reduce hunger and poverty.) It was pointed out that in today's agricultural system, with the recent population growth; there is a need to produce more with fewer resources. As those become scarcer over time, NUS become a well-desired intervention, using less input and being adapted to harsh environments. They can be seen as a remedy for the limited diversification in agriculture and be easily included in cropping systems by inter- and relay cropping, enhancing yields and being beneficial to the environment. In this regard, a paradigm shift toward sustainable intensification has to take place. Additionally, agriculture needs to be made more intellectually challenging, especially for young people. Therefore, NUS and agrobiodiversity need to find their way into school curricula. NUS also need to be promoted at grass roots level, starting from their economic potential to be considered already in crop development. Awareness raising needs to be done at ground level and requires a systemic change. Some support can be sought from big market actors, such as supermarket chains as well as new niche markets, including the organic sector. In all discussions, the priority of food security and improved nutrition should be kept in mind. Nutritional programmes for smallholders, starting from local high-nutritive crop production, that are complementary to proper Government back up and supported by international communities will remain indispensable.

B. Technical Sessions

Session 1: Setting the Scene: Enabling environment required for NUS to address hunger and malnutrition

The first Session featured a set of presentations on the requirements for an enabling environment for NUS to address the major challenges of hunger and malnutrition. Each presentation was followed by a short session of Q&A, which will be summarized at the end of this chapter.

In the first presentation, **Dr Visith Chavasit**, Ex-Director and Professor at the Institute of Nutrition of Mahidol University, presented about the challenges NUS face in relation to production, consumption and marketing. He highlighted that several factors have contributed to the disappearance of important species and varieties, which are now less available. Some important factors include a shift to single cropping to serve market needs, a change of eating patterns and consumer preferences, as well as cultural invasion. In the past, communities in the region have been sourcing their food from the forest, which can be considered as a "community supermarket". Although being poor, people have been able to feed themselves. At the same time, they managed to sustainably use forest resources and maintain agrobiodiversity. Meanwhile, countries have experienced a shift to production of only few staple crops, due to the pressing cash crop and mono-cropping culture, which is partially caused by export competition. Mono-cropping generally requires more inputs and negatively affects local eco-systems, contributing to biodiversity loss and natural resource degradation. Dr Chavasit underscored the importance of cultural diversity and preservation of traditional knowledge, including the promotion of local cooking practices. He also discussed the importance of a marketing concept to promote NUS as valuable and high-potential crops highlighting their health and nutrition benefits to raise awareness by educating consumers. Furthermore, he listed research and stakeholder participation as important entry points to create an enabling environment for NUS.

Dr Abid Hussain, Food Security Economist on Livelihoods from the International Centre for Integrated Mountain Development (ICIMOD), focused on the contributions of NUS to addressing hunger and malnutrition in mountainous areas. In light of climate change, entailing erratic weather events, as well as heat and drought stress, he highlighted the benefits of NUS, especially for the rural poor in mountainous landscapes. Populations in mountainous regions are more prone to nutrition insecurity and stunting, therefore, NUS can be a promising and economically viable source to make them less vulnerable to market shocks. NUS require fewer inputs and provide a good source of nutrients. In the past, some NUS have been part of the food basket, for example barley in Pakistan. But farmers in mountainous areas do not benefit, while the middle man earns, which is why they switch to staples. Several factors make NUS less favourable, including low yields, low market value and demand, lack of incentives and subsidies, changing food habits and preferences, increased income levels, a decline in cultivation area, as well as lack and inefficient documentation of indigenous knowledge on collecting, harvesting, cooking and consumption from 'our grandfathers and grandmothers'. He mentioned that even when marketing and sales of certain crops are increased, it does not necessarily mean that consumption increases as well. An integration of NUS into the food basket has to be demand-driven. That is why he emphasized on

promoting the local food sectors, including the private sector, and to link traditional food systems with eco-tourism. He discussed the need for enabling supportive policies and activities that NUS with national school nutrition programmes that will eventually increase the demand of NUS. He also highlighted the importance of value chain development for NUS, underlining their good economic potential for value addition and organic certification.

Dr Mohd Desa Hassim, Chief Executive Officer (CEO) of TFNet, highlighted the commercial value of fruits and raised the question why some fruits, despite their potential, are underutilized. He listed some challenges related to NUS, especially their need to compete with commercial fruits such as banana, papaya, water melon and dragon fruit. He also pointed out that high costs are involved in large scale production of certain NUS crops, while seasonality and limited shelf life restrain their promotion into markets. Neglected and underutilized fruits often do not have an appealing look to consumers and need to be processed. He underscored the importance of developing agricultural value chains for NUS, and in particular, the need for creating policies that are supportive of NUS along the entire value chain, which can be regarded as a circle, in which the consumer reports back to input supply. He identified policy gaps and urged to put NUS into policies and education systems by including them into school curricula and develop a road map with action plans, while at the same time reducing bureaucracy. He illustrated that some fruits, such as kiwi, have been successfully introduced into markets, while other promising crops, e.g. mangosteen, remain underutilized. New lifestyles require innovations to promote these promising fruits, for example, processing them into tablets for easy micronutrient intake, wine, vinegar, etc., need of innovation. In that regard, Geographical Indication (Dabai in Malaysia) and fortification (Moringa in the Philippines) can play a role and facilitate better marketing opportunities. He agreed that in order to address national food concerns, suitable NUS need to be identified and policies aligned to country needs. An enabling policy environment would include levies, taxes, and access to bank collateral with regard to inputs, commodities and investments. He also emphasized the importance to preserve biodiversity, promote research, extend and share germplasm, list promising species and create a database.

Dr Shankar B Dandin, Liaison Officer from BI Project Office in Bengaluru, India, presented a case study from India. The case study focused on improving food basket diversity by promoting NUS fruits, roots and tubers, and pulses. He mentioned that a Genetic Diversity Park, a crop-based research stations in India, was established to preserve many varieties and different species of NUS. One of the main focuses is to mainstream minor NUS crops into consumption, commercialisation, cultivation and conservation by increasing their promotion and use. He pointed out that several crops, e.g. jack fruit, have multiple purposes: medicinal use, protein supplement, roti flour, fire wood, and as

such being an integral part of household gardens. Promotional activities include the use of multi-nutrition-package fruits in home gardens, promotion of their health and nutritional benefits, change family mind sets and introduce processing and cooking practices to support family nutrition. Certain NUS species show great potential not only in terms of economic, ecological and nutrition value, but also feature benefits in terms of agronomic practices, such as pest control management. In this regard, the views and aspirations of custodian farmers need to be considered to increase availability improve planting modalities and develop community seed banks, nurseries and orchards. While promoting NUS marketing and value adding, the importance of education, capacity building and awareness raising among farmers and young people in particular is crucial to a consumption increase of NUS. He also stressed the importance of partnership with the food industry, especially with regard to adding value. He re-emphasized the need to document indigenous knowledge of NUS, and need for further research on food composition data and nutrient analysis. Establishing a global body or platform working primarily on NUS will facilitate the promotion of NUS in the future, by sharing information, research and knowledge.

Mr Shridhar Venkat, CEO of the Akshaya Patra Foundation, introduced the Mid-day Meal Scheme in India, a flagship intervention of the Indian Government and the world's largest school meal programme. While 60 percent of funding is provided by the Government, 40 percent of financial contributions come from the private sector. He highlighted that no child in India shall be deprived of education because of hunger. The organization's focus lies on foods that are sourced from local producers and cooked at the local school canteen for school children. As consumption patterns are context-specific, every location has its unique meal delivered to schools. The programme is supported by the Government, strengthens public and private partnership and provides economic, safe and nutritious meals to kids. He underlined the potential to include NUS in school meals and highlighted the importance of improved cooking practices and development of nutritious recipes. In order to promote NUS, awareness about their benefits needs to be created and integrated into school curricula. An essential aspect of the programme is an accurate and well-functioning monitoring system to measure and assess gaps as well as improvements. By 2020, the organization's goal is to feed five million children. 'When it comes to hunger, the best figure is zero', he stated and gave an outlook of the objectives beyond 2040.

Prof Prakash Shetty, CEO of the LANSA Research Programme Consortium under MSSRF-LANSA, introduced the pathways between agriculture and nutrition and discussed the research activities of his seven-year LANSA project in South Asia (India, Bangladesh, Pakistan, and recently Afghanistan) with a special focus on nutrition-sensitive agriculture interventions and a participatory design that incorporate NUS. 50 percent of the workforce in the region is employed in the agriculture sector, of which a large part is assigned to women. Within its three pillars, LANSA emphasizes therefore the

importance of gender balance and women involvement. The LANSA project is led by the M S Swaminathan Research Foundation and promotes an integrated and harmonized approach to reducing hunger and nutrition. Interventions include not only health and nutrition aspects for promotion of NUS, but also an economic perspective and income benefits. Activities also include improvement of varieties and biofortification of selected NUS crops. He pointed out that a shift to quality of diets has taken place and that nutrition is gaining more importance in countries in the last few years. Nevertheless, nutrition education and raising awareness on the nutritional value, cooking techniques, and recipe development are crucial and have been important parts of the programme. Referring to a study in India, he highlighted that agriculture interventions not necessarily improve nutrition and that nutritional outcomes depend on the way States operate. He stressed the importance of value chain research and diversifying production systems, including animal production. The economic viability of NUS has to be proven to raise incomes, increase production area and promote selected crops in community gardens, in households and at institutional level (schools).

The following key messages have been discussed during Q&A sessions:

- Demand of fruits is rising and they become increasingly affordable. NUS fruits are of high nutritional and commercial potential and consumption should be promoted at household level.
- It is of high importance to change consumption patterns and improve the perception of NUS by raising awareness and educating people about their importance.
- There is a need to identify NUS varieties that achieve high yields and are resistant to pests to convince farmers to incorporate NUS crops into their fields.
- Food processing and marketing opportunities within further value chain development can help to increase the acceptance of NUS, promote consumption and create market demand.
- Both physical and economic access and availability to NUS are essential and national policies that are supporting not only output- but also nutrition-based subsidies could be a starting point for national governments.
- Multisectoral nutrition programmes should consider and design interventions on NUS, especially targeting the most vulnerable groups, such as pregnant and lactating women, complementary feeding for young children.
- A holistic NUS index on production, nutrition and consumption (bioavailability), indicating the value per crop (not only based on volumes), as well as a classification based on the countries' nutritional deficiencies, e.g. protein, vitamin A, zinc, iron, would be useful to prioritize certain NUS. It could be translated into a mapping exercise and proposed nutrition-sensitive packages of crops. In this regard, policies need to be adjusted accordingly.
- It was stressed that documentation of good case studies, sharing of good practices and lessons learned is needed to understand complexities, to convince consumers and policy makers to promote NUS and frame new projects.
- Cost benefit analysis of different interventions that are promoting NUS, as well as commercial considerations will be important.

- The initial introduction process has to be kept in mind. Selected NUS, for instance, could be introduced to communities who may or may not be familiar with them to try their performance, bring them in line with preferences and complement with knowledge provision (e.g. coloured rice).
- Prof Shetty pointed out that HarvestPlus activities helped to introduce high-potential crops such as orange sweet potatoes in his project. Nevertheless, it was only introduced where already known.
- Farming systems should be made sustainable and nutrition-oriented in the long term, incorporating livestock production and other income sources to increase farm feasibility and resilience

  Example: Home gardens in Bangalore, where household were provided with a package of 10 trees (coconut, pomegranate, jack, etc.)
- It will be important to look at potential fruits in the back yards of households (e.g. jack fruit) and seek opportunities for scaling up. Moringa is a good example as well.
- Marketing programmes that include women groups with knowledge about traditional recipes can help to promote NUS.
- Despite the potential of household and family approaches, markets need to be considered as well to commercialise NUS for scaling up.
- Before scaling up production, cultivable land for smallholders needs to be considered and assessed.
- A multidimensional approach is essential, including social protection, to mitigate risks that are connected to competition between production and trade, as well as production and consumption.
- With regard to school feeding schemes, a breakfast option should be considered to start the day with good nutrition and no hunger before school even starts.
- Evidence is important and will convince stakeholders and consumers of the benefits of NUS. Once nutrition studies on jack fruit in Bangladesh had been available, the outcomes led to high prices.
- It will also be important to provide and maintain seedlings for planting, and to create a market for that (Strategic plan for next three years?)
- In this regard, successful marketing stories should be assembled and published.

Session 2: Scoping, Validation and Prioritization of NUS – Country Group 1

Overview and Scoping of the Availability and Potential of NUS in Nepal

The review of preliminary scoping studies was conducted country by country starting with Nepal. Each country scoping was reviewed by international partners from three disciplines, 1) agriculture and ecology; 2) nutrition and 3) socio-economic, followed by a plenary debate and a wrap-up session with final nomination of prioritized crops in the country. Dr Li re-emphasized the task of the review exercise, which are I) to assess, if there are gaps in the identified NUS list, and II) to validate, if the data has been displayed correctly.

Dr Renuka Shreshta from the Nepal Agriculture Research Council presented the preliminary scoping results on NUS in Nepal. She gave an overview of the geographical zones in the country, the share of agriculture in the overall economy and underlined the country's diverse agricultural diversity. She highlighted major issues in agricultural research and development (R&D) and pointed out that investment in research and private interest in NUS are very low. For instance, 17 commodity research programmes in Nepal focus mainly on staple crops such as coffee, wheat, potato, maize and other commercial crops. Some efforts have been undertaken to promote NUS, for example, under IFAD and Bioversity International in a home garden programme. Furthermore, the Hill Crops Research Program (HCRP), established in 1987 aimed at increasing the availability of hill crops such as finger millet, barley and Mithe (sweet buckwheat).

Dr Shetty gave an overview on the nutritional situation Nepal, indicating that stunting, as well as anaemia and vitamin A deficiency rates are still above 40 and 30 percent respectively. He highlighted the nutritional value of a few NUS, including tartary buckwheat, amaranthus, sorghum, millets and pulses in general, orange sweet potato and spinach. He also re-emphasized the importance of social acceptance and ethnic values associated with selected crops.

Dr Hussain pointed out that the discussion of socio-economic aspects in the preliminary scoping results, including market constraints, was very limited, so that it is hard to draw any concrete conclusions. With regard to socio-economic factors, labour scarcity due to outmigration seems to be an issue in the country. When labour is short, farmers turn away from less feasible crops and stop cultivating NUS. Next to outmigration, seasonal migration (less than six months) plays an important role as well. He prioritized eight crops based on his assessment, but also raised the question, if successful crops, such as buckwheat and millet, can be regarded as NUS. The eight crops included millets, buckwheat, black gram, horse gram, black lentil (French market), local beans (fava, rice and velvet beans), fenugreek and flax seed (alsi).

Summary and Output Generation Based on Review of Discussants from a FAO Perspective

In light of high rates of stunted (40.5 percent) and wasted children (11.2 percent), high rates of anemia (36.1 percent), vitamin A deficiency (33.0 percent), and obesity (21.0 percent female, 14.0 percent male), the following NUS were prioritized after the plenary discussion (***Table 1***):

Table 1: Prioritized NUS in Nepal sorted by food groups

Cereals	1. *Setaria italica,* foxtail millet 2. *Panicum miliaceum,* proso millet 3. *Sorghum bicolor*, sorghum *4. Amaranthus cruentus* 5. *Fagopyrum tataricum,* bitter buckwheat – high nutritional value
Roots and Tubers	1. *Colocasia esculenta*, taro 2. *Dioscorea alata*, greater yam, white yam 3. *Amorphophallus paeoniifolius*, Elephant foot yam 4. *Dioscorea nepalensis*, deltoid yam 5. *Ipomoea batatas*, sweet potato
Nuts and Pulses	1. *Vigna umbellata*, rice bean 2. *Macrotyloma uniflorum,* horse gram 3. *Lathyrus sativus*, grass pea 4. *Pisum sativum*, small pea – indigenous to Nepal, different colours 5. *Vicia faba*, Faba bean – small and large
Horticulture	1. *Sechium edule,* Chayote 2. *Moringa olifera*, drumstick 3. *Benincasa hispida*, ash gourd 4. *Trigonella foenum-graecum*, fenugreek 5. *Chenopodium album*, lamb's quarter 6. *Amaranthus gracilis*, Green amaranth 7. *Phytolacca acinosa*, sweet belladonna 8. *Artocarpus heterophyllus,* Jackfruit 9. *Aegle marmelos*, wood apple 10. Amla, *Emblica officinalis*, Indian gooseberry 11. *Annona squamosa*, custard apple 12. *Tamarindus indica*
Oilseeds and Spices	1. *Linum usitaissimum*, linseed 2. *Guizotia abyssinica*, Niger 3. *Bassia latifolia*, Nepali butter tree *4. Perilla frutescens* 5. *Zanthoxylum armatum*, Nepal pepper

Overview and Scoping of the Availability and Potential of NUS in Lao PDR

Dr Siviengkhek Phommalath from the National Agriculture and Forestry Research Institute (NAFRI) started his presentation with an introduction to the climate and agricultural development in Lao PDR. Mountainous areas account for 80 percent of total land surface. Glutinous rice is the main staple and accounts for 80 percent of total rice production. Rice occupies 60-70 percent of total crop area and meets the country's own demand. Policies are in favour of cash crops, such as rice, sugar cane, maize, coffee, rubber and cassava. With regard to undernutrition, major concerns in the country are a remaining stunting rate of 35.6 percent and underweight prevalence of 25.5 percent. The National Nutrition Strategy to 2015 aims at the elimination of nutrition and NAFRI's policy directives envisage food security, increased income and sustainable utilization of natural resources. He highlighted that the country is rich in biodiversity and farmers usually grow two to three crops. In 2007, non-timber Forestry Products (NTFPs) accounted for 44 percent of household subsistence in Lao PDR, showing the potential for NUS. Sorghum was prioritized as a cereal due to its low water use and high protein content. It can be grown in gardens, fields and forests and ethnic groups mix it with other food sources. At the current state, it is mainly being used for animal feed. Within the group of pulses, mung bean, rice bean and cow pea were selected according to their high protein content and suitability for animal feeding. He noted that tuber crops, such as cassava, supplement the food basket in times of rice insufficiency (July to August); therefore, prioritized tubers such as purple yam and taro can play an important role. The main constraints for NUS in Lao PDR are limited information on NUS, including germplasm and production knowledge, lack of marketing opportunities, inputs and investment. Research and Development on these aspects, as well as private sector engagement may be leading the way to NUS promotion in Lao PDR.

Dr Yuchun Pang, Researcher and Director from CATAS-TCGRI, assessed the results from an agricultural and ecological perspective, and acknowledged most of the species that had been prioritized by the national expert. He suggested two more vegetable crops worthwhile promoting: Leafy sweet potato (*Ipomoea batatas*) and water dropwort (*Oenanthe javanica*), which are both nutrient-rich and high-yielding vegetable sources in China.

Dr Anadi Nitithamyong, Assistant Professor from the Institute of Nutrition at Mahidol University, reviewed the results from a nutrition perspective. She stressed the lack of a food composition data base, as well as data on bioavailability and food consumption. To fill the data gaps, they used the USDA, Thai and ASEAN data bases. She pointed out that countries show overlaps in terms of their prioritized crops, which can facilitate a collective effort in promoting NUS. Her suggestions for NUS prioritization towards high protein and micronutrient content included finger millet, sorghum, purple yam, cow pea, rice bean and mung bean.

Mr Max Herriman, from Crops for the Future, assessed the results from a socio-economic perspective. He stressed the need for a compelling business case and provided a checklist for the country to go through when revising their country study, including information on total annual production, imports and exports, price trends, profitability, labour, inputs and associated costs, as well as market demand. He emphasized the importance of identifying NUS with the clear potential to address country-specific nutrition needs, climate change and socio-economic factors such as creation of employment, wealth distribution and market potential.

Summary and Output Generation Based on Review of Discussants from a FAO Perspective

The following NUS were prioritized after the plenary discussion:

Table 2: Prioritized NUS in Lao PDR sorted by food groups

Cereals	1. *Sorghum bicolor* 2. *Eleusine coracana*, finger millet
Roots and Tubers	1. *Dioscorea alata*, purple yam 2. *Colocasia* sp., Taro
Nuts and Pulses	1. *Vigna radiate*, mung bean 2. *Vigna umbellata*, rice bean 3. *Vigna unguiculata*, cow pea
Horticulture	1. *Ipomoea batatas*, leavy sweet potato 2. *Oenanthe javanica*, Water drop wort

Overview and Scoping of the Availability and Potential of NUS in Cambodia

Dr Kynet Kong, Deputy Head of the Plant Breeding Division at the Cambodian Agricultural Research and Development Institute (CARDI), gave an overview on the agriculture sector in Cambodia. He pointed out that 31 percent of national Gross Domestic Product (GDP) accounts for the sector, of which more than half is dedicated to crop production. Rice occupies the main share of production area (79.4 percent in 2014), followed by improved varieties of cassava, maize and soybean (10.3, 5.7 and 2.1 percent). He introduced NUS in Cambodia as mainly representing traditional landraces. Diversity of NUS is rather high, and farmers contribute to genetic diversity in their fields by maintaining traditional practices. Nevertheless, due to being neglected and underutilized, risk of extinction and genetic erosion are likely to happen for many of these local varieties. Other aggravating factors are staple-biased monocultures, population growth, droughts and lack of infrastructure. The major constraints for NUS are low productivity and insufficient consumer acceptance, making them less competitive compared with other mainstream crops. Furthermore, they are continuously replaced by improved varieties that can also provide better nutritional values. Dr Kong stressed that germplasm should be well-documented to preserve local varieties. He also opted for sustainable production practices for NUS to be developed by research, as well as improved marketing opportunities for these crops.

Based on the review by Dr Pang, rice landraces were taken out of the proposed crops from Cambodia, although it was agreed that their germplasm should be preserved. He underlined the value of rice bean and *Vigna unguiculata* species, as well as yam, custard apple and Amla. Other suggested crops included finger millet, arrow root, various yam species and Burmese grape. He also highlighted the emergency relief potential of sweet potato. Other experts stressed the need to further discuss value addition and commercialisation, climate constraints, seasonality, as well as cropping systems that can accommodate potential NUS.

Dr Nitithamyong made similar observations in her nutrition review as for Lao PDR, indicating a lack of food composition data, as well as information on bioavailability and food consumption. She highlighted the nutrition potential of finger millet, rice landrace, purple yam, rice bean, groundnut, Amla and wild mango. During the panel discussion, she put emphasis on the promotion of *Coccinia* sp. for vitamin A intake. She also made a reference to the Regional Data Centres on food composition, which are hosted by Mahidol University and can be accessed at ASEANFOODS[1]. It was again agreed that first, malnutrition symptoms should be defined in the country in order to identify suitable NUS that can "treat" these symptoms.

Mr Herriman stressed that the decisions made on crop choices should not be done prematurely without considering socio-economic factors, which were again too little discussed in the Cambodian study. He pointed out that the study focused too much on preservation of species. He was missing the

[1] http://www.fao.org/infoods/infoods/regional-data-centres/aseanfoods/en/

discussion on other challenges for NUS such as policy, investment, financial, and agronomic constraints, and consequently the argumentation why certain NUS should be selected. Instead of groundnut, he suggested Bambara groundnut due to its resistance to high temperature, adaptability to marginal areas and a superior nutrition potential.

Summary and Output Generation Based on Review of Discussants from a FAO Perspective

Based on the review and plenary discussion, the national expert prioritized the following twelve NUS:

Table 3: Prioritized NUS in Cambodia sorted by food groups

Roots and Tubers	1. *Dioscorea* sp., yam 2. *Colocasia* sp., taro 3. *Ipomoea batatas*, sweet potato
Nuts and Pulses	1. *Vigna unguiculata*, cow pea 2. *Vigna unguiculata* subsp. *sesquipedalis*, yardlong bean 3. *Vigna unguiculata* subsp. *unguiculata*, black-eyed pea 4. *Vigna umbellata*, rice bean
Horticulture	1. *Cucurbitaceae* 2. *Coccinia grandis*, ivy gourd 3. Amla, *Phyllanthus emblica*, Indian gooseberry 4. Wild mango 5. *Annona reticulata*, custard apple

Overview and Scoping of the Availability and Potential of NUS in Myanmar

Dr Minn San Thein, Deputy Director and Head of the Myanmar Seed Bank at the Department of Agricultural Research (DAR), gave an introduction to the nutrition and agriculture status in his country. More than 70 percent of people live in rural areas and rely on agriculture for work and subsistence. He highlighted the diversity of farms in Myanmar, often accommodating more than 20 species in one field. Although many species are neglected and underutilized, traditional knowledge on cultivation and preparation plays a big role and often, NUS are collected from the forest. He suggested a total of fourteen species from different food groups and also introduced possible interventions for their promotion. Next to nutritional value, he listed export potential, climate change adaptation and local consumption, such as lablab bean in traditional pickle tea, as factors for prioritization.

Dr Dandin commented on the prioritized list and suggested to replace some proposed crops by e.g. drumstick, jackfruit and custard apple. He also noted that information on nutrition, production, ecology (abiotic stresses), and marketing of selected NUS has not been sufficiently provided in the study. He asked for more details on geographical zones in Myanmar and their characteristics in terms of temperature, rain fall and soil type, dominant cropping systems, postharvest and waste management practices, processing and storage, as well as identification of technical resource institutions. As an additional note, he announced to forward a list of identified NUS for Asian countries from the International Centre for Underutilized Crops to all participants.

Dr Nitithamyong referred to nutrient data from USDA due to lack of food composition data for Myanmar. She suggested sorghum, elephant food yam, sesame, cow pea, groundnut and Amla as high-potential NUS from a nutrition perspective. Experts also suggested to consider anti-nutritional factors in NUS and to find ways how to overcome these, by e.g. processing.

Mr Herriman raised the question if food security and malnutrition are the only quests in Myanmar. He suggested to the country expert to go through the proposed checklist for socio-economic parameters and include aspects of marketability and economic viability for selected NUS to the study.

Summary and Output Generation Based on Review of Discussants from a FAO Perspective

The following list of NUS emerged after the review and plenary discussion:

Table 4: Prioritized NUS in Myanmar sorted by food groups

Cereals	1. *Sorghum bicolor* 2. *Oryza sativa*, aromatic rice
Roots and Tubers	1. *Amorphophallus paeoniifolius*, elephant foot yam
Nuts and Pulses	1. *Lablab purpureus*, lablab bean
Horticulture	1. *Hibiscus sabdariffa*, Roselle leaves 2. *Lagenaria* sp., bottle gourd 3. *Moringa olifera*, drumstick 4. *Artocarpus heterophyllus*, jackfruit 5. Amla, *Phyllanthus emblica*, Indian gooseberry 6. *Annona squamosa*, Custard apple

Plenary Discussions

During the plenary discussion, several constraints and opportunities with regard to NUS were discussed. Several experts shared the view of linking country-specific nutrition issues, such as undernourishment and stunting, with suitable NUS that can alleviate them. Many farming systems are subsistence-driven: how can they be improved? The participants also highlighted the need for locally available and feasible germplasm, planting material and seeds. It was suggested to develop missions for prioritized crops, such as a "millet mission" that involves all relevant stakeholders of this respective value chain. In terms of the other criteria, specific parameters need to be decided on, to select the highest-potential crops in each country. In this regard, it will remain important to look at economic factors and to identify corresponding incentives. Two types of incentives are relevant, which are market incentives and a shift of government resources towards NUS. For that, experts need to allow governments and ministries to understand the benefits of NUS by showing them successful results and market factors that sell well. It was discussed, if scientific papers will be relevant enough and convince decision makers. To achieve change on the ground, papers have to make a business case about NUS (assessment by an economist?), which can be facilitated by FAO. Once countries have selected their priority crops, studies have to run through a "business case filter" to prove their potential for viable production. Only then will decision makers take notice of NUS. Careful attention has to be paid to conflicts between interests. Investment in NUS will not please institutions that, for example, heavily invest in rice research. What will sell is that the current status quo with regard to climate change is not an option. To make a case, NUS have to be part of a sound business package. Governments can provide direct and indirect investment, e.g. enhanced education and research, in NUS. Policies on trade, freedom of trade, and incentives for private sector investment will play an important role, as decision makers also include heads of private sector, who in general only think in economic terms. This should not be neglected, when talking about the promising social and environmental dimension of NUS. The private sector also holds significant marketing knowledge, which will be useful to further promote NUS value chains. Experiences in Thailand show that young people increasingly want to learn about local production and food self-sufficiency approaches, such as back yard cultivation. Another option is the cutting out of middle men in food value chains and to promote farm products to consumers directly.

After a wrap-up by Dr Li at the end of Day 2, **Mr Savanh Hanephom** from Lao PDR addressed his policy roundtable talking points. The full document is provided in Annex 7.

Session 3: Reviewing the State of the Art on NUS – Country Group 2

Overview and Scoping of the Availability and Potential of NUS in Vietnam

Dr Pham Hung Cuong, Deputy Director General from the Plant Resources Centre in Vietnam, started his presentation with an introduction to the country's climate and agro-ecological zones. A large share of the population lives in rural areas and the economy is heavily dependent on agriculture. This makes the country especially prone to climate change impacts, including sea level rise, droughts and floods. The country is rich in plant genetic resources and the highest species variety can be found in the groups of fruits, non-starchy food crops and vegetables. The main crops in Vietnam are rice, maize, sweet potato and cassava. Intensive cultivation of only a few crop varieties has led to a loss of an estimated 80 percent of local crop varieties. Although the Government has declared to introduce policies in favour of NUS, no legal documents have so far been prepared. The constraints for NUS promotion are lack of research, information, inventory management and monitoring, as well as dedicated, long-term strategies and enabling policies. Dr Pham based the prioritization of NUS on their adaptability to local conditions, choice and acceptability by the local population, their food and nutrition strength, as well as economic sustainability for producer groups.

From an agriculture and ecological point of view, Vietnam is prone to erosion and rain fall. These aspects have to be considered when prioritizing NUS. There is, for instance, high diversity of fruits in the up- and midlands. More such cropping information will be required to identify suitable NUS that fit into the country's farming systems.

For Vietnam, food composition data has been available, while information on bioavailability and food consumption has been lacking. Dr Nitithamyong prioritized finger millet, sorghum, as well as other cereals, and pulses for their superior protein content. In addition, purple yam (anthocyanin), elephant yam, pumpkin (β-carotene) and amaranth (calcium, vitamin C) were favoured with regard to their nutritional value.

Although Mr Herriman complimented on the comprehensiveness of the study, he gave similar comments with regard to the study as in earlier country sessions: Lack of information for a sound business case, no indication of projected strategies, especially with regard to climate change adaptation, and missing details on the superiority of NUS from a socio-economic point of view (blank table). He again provided a checklist for revision of the socio-economic analysis of NUS in the country scoping study.

Summary and Output Generation Based on Review of Discussants from a FAO Perspective

Based on the review and plenary discussion, the following NUS were prioritized (***Table 5***):

Table 5: Prioritized NUS in Vietnam sorted by food groups

Cereals	1. *Eleusine coracana*, finger millet 2. *Setaria italica*, foxtail millet 3. *Fagopyrum esculentum*, buckwheat 4. *Coix lacryma-jobi*, adlay millet, job's tears
Roots and Tubers	1. *Colocasia* sp., taro 2. *Dioscorea alata*, greater yam 3. *Canna* (edible) 4. *Amorphophallus paeoniifolius*, elephant foot yam
Nuts and Pulses	1. *Vigna angularis*, Adzuki bean 2. *Vigna umbellata*, rice bean 3. *Vigna unguiculata*, cow pea 4. *Vigna radiata*, mung bean
Horticulture	1. *Amaranthus gracilis*, green amaranth 2. *Cucurbita* sp., pumpkin 3. *Allium schoenoprasum*, chives 4. *Cardiopteris quinqueloba* 5. *Melientha suavis* 6. *Artocarpus heterophyllus*, jackfruit 7. *Lansium parasiticum*, Langsat 8. *Clausena lansium*, Wampee 9. *Prunus* sp., Plum

Overview and Scoping of the Availability and Potential of NUS in Bangladesh

Dr Md Amjad Hossain, Director of the Training and Communication Wing at the Bangladesh Agriculture Research Institute (BARI), held a presentation on the importance and scope of NUS in Bangladesh. He briefly introduced his country's geographical location, climate, and agriculture. The agriculture sector employs 25.7 percent of the total labour force and labour scarcity is a big problem in Bangladesh. Cropping intensity accounts for 191 percent and rice is the major crop with 78 percent of total production area and 33.8 percent of total production volume. The country covers 30 different agro-ecological zones and some ecosystems are stress-prone, while overuse of agricultural chemicals is common. He stressed that many NUS that are now neglected were previously important crops in the world. He listed some benefits of NUS, including their adaptation to different agro-ecological niches, as well as their importance in local consumption and production systems. Biggest constraints are changes in diets, loss of traditional knowledge, inadequate awareness of the nutritional value of NUS and a perceived low status. Genetic erosion of NUS is happening due to

droughts, fires and other natural factors aggravated by climate change. With regard to economic considerations, NUS feature low commercial value, compete poorly with other crops, have no markets and incentives for farmers to grow them are lacking. Seed supply systems or NUS and planting material as well as seeds are nearly nonexistent. Furthermore, NUS are not prioritized in national policies and a link between their conservation and use has yet not been made. He showed that Bangladesh is rich in plant genetic resources and introduced crop gene bank resources according to food groups. He also pointed out that only a limited number of them are used in crop improvement programmes. He proposed a long list of high-potential NUS that were subsequently reviewed and reduced during plenary discussions (***Table 7***).

Dr Yashpal Singh Saharawat, Senior Agronomist and Country Manager in Afghanistan for ICARDA assessed the scoping results from an agriculture and ecological point of view. He pointed out that data availability was limited and that a foresight approach for NUS has been lacking. Based on the ICARDA approach, he shortened the number of crops suggested by Bangladesh mainly based on their suitability for certain agro-ecological and their existence in national cropping systems zones. Mung bean, for example, could fit well into a rice-fallow system (15 million ha in South Asia), while yam and taro go well with agroforestry systems. It was suggested to use improved varieties to fill the yield gaps and to also increase farmers' awareness on improved varieties. He also introduced a success story on relay cropping with lentil.

Dr Shetty pointed out that undernourishment (16.4 percent), stunting in children (36.1 percent), anaemia and vitamin A deficiency (43.5 and 28.0 percent respectively) are very high in Bangladesh, and that he prioritized NUS based on their nutrient contents. He noted that food composition data has not been available and suggested, in order to clarify the prioritization of NUS from a nutritional perspective, to develop a global table on their nutrition benefits. He also recommended reducing selected crops for Bangladesh to 5-6 NUS.

Dr Hussain reviewed the study results on NUS from a socio-economic. He pointed out that challenges for NUS have been listed, but have not been discussed or justified. For instance, in which regard do NUS lack competitiveness compared with other crops? The report mentioned the lack of incentives, but it was not specified what kind of incentives would be needed. He asked for more specifications and discussion on these issues. He also found some inconsistencies in the table on aggregated NUS data.

Summary and Output Generation Based on Review of Discussants from a FAO Perspective

Based on the extended list provided by Bangladesh, the following NUS were prioritized after review and plenary discussions (***Table 6***):

Table 6: Prioritized NUS in Bangladesh sorted by food groups

Cereals	1. *Setaria italica*, foxtail millet 2. *Hordeum vulgare*, barley 3. *Fagopyrum esculentum*, buckwheat
Roots and Tubers	1. *Dioscorea* sp., Yam 2. Panikachu, *Colocasia esculenta*, taro 3. Mukhikachu, *Colocasia esculenta*, taro 4. Mankachu, *Alocasia macrorrhiza*, giant taro 5. *Ipomoea batatas*, sweet potato
Nuts and Pulses	1. *Vigna radiata*, mung bean 2. *Cajanus cajan*, pigeon pea 3. *Vigna unguiculata*, cow pea 4. *Lathyrus sativus*, grass pea 5. *Pisum sativum*, field pea
Horticulture	1. *Trichosanthes cucumerina*, snake gourd 2. *Manilkara zapota* 3. *Syzygium cumini*, jamun 4. *Phaseolus vulgaris*, french bean 5. *Aegle marmelos*, wood apple 6. *Luffa* sp., ridge gourd 7. *Cucurbita* sp., pumpkin 8. *Momordica charantia*, bitter gourd

Overview and Scoping of the Availability and Potential of NUS in West Bengal, India

Dr Apurba Chowdhury, Professor and Ex-Dean of Uttar Banga Krishi Viswavidyalaya, delivered a presentation on Preliminary Scoping of NUS in West Bengal, India. He highlighted that the recent population in India accounts for 80 million and that cropping intensity is very high at 237 percent. Significant reasons to consider NUS are stagnation of yields, a current yield gap, consumer preference changes, a good export base, and climate suitability. He also pointed out that some underutilized crops are already included in fields and complement farm income. Dr Chowdhury indicated that West Bengal has a vegetable-based food basket and is number-one State in vegetable production in India. Nevertheless, hunger, malnutrition, as well as high child and infant mortality prevail in India. Furthermore, a decline in production area and productivity, an increase in irrigated area, non-awareness of the benefits of NUS benefits, as well as a lack of seed supply systems and storage inhibit the promotion of promising neglected and underutilized crops. Dr Chowdhury suggested strategies to overcome these problems by e.g. including NUS in cropping systems with rice, enhancing crop health management and value addition, and addressing policy

issues. He also presented a participatory seed producer model for replacement of local seeds and highlighted the potential of pulses.

Dr Saharawat underlined the potential for pulses in rice fallow systems, which account for 40 percent in the winter season. Evidence also shows that lentil and grass pea fit into existing cropping systems, and increase farm area and productivity. He agreed with the crops proposed Dr Chowdhury and finally mentioned the need to seek private sector knowledge and expertise for value addition of selected NUS.

Dr Shetty complimented the extensive food composition data provided by West Bengal. He pointed out that aromatic rice, shortlisted by the national expert, has commercial advantages but does not contain significant nutritional value. India has almost 200 million undernourished people. In West Bengal, 32.5 percent of children are stunted, 20 percent wasted and anaemia accounts for 54.2 percent. He explained that stunting is a complicated issue, being influenced by multiple factors during childhood, especially in the early stages of weaning and introduction of complementary feeding. He also indicated that social factors are important and that chronic and acute malnutrition can be tackled by improved sanitation and other preventive measures. He also emphasized the need for long-term strategies, considering employment, education and women empowerment. From a nutritional point of view, Dr Shetty prioritized pulses, groundnut and *Amaranthus*. He also mentioned that the statistics provided by the expert are reliable.

Dr Hussain pointed out that 84 percent of state land in West Bengal is held by medium and smallholder farmers. NUS, such as pulses are neglected due to their poor yields and farmers often go for cash crops due to better prices. He noted that the scoping study featured a good analysis and that socio-economic factors were discussed in general. He missed a more detailed discussion on NUS, including policy gaps, the demand side, market linkages and accessibility, and potential economic benefits. Furthermore, the unit of analysis was not mentioned in the table on aggregated NUS data. Dr Hussain emphasized the importance of raising awareness and to build capacity of farmers for NUS production increase, and suggested to consider native, more micronutrient-rich crop varieties.

Summary and Output Generation Based on Review of Discussants from a FAO Perspective

It was agreed that aromatic rice, being an underutilized crop with limited planting area in West Bengal, be included in the list of prioritized NUS. Carrot was also included due to its high content of Vitamin A. Participants discussed and agreed on the following NUS (***Table 7***):

Table 7: Prioritized NUS in West Bengal, India sorted by food groups

Cereals	1. Kalonunia, *Oryza sativa*, black rice
Nuts and Pulses	1. *Lens culinaris*, lentil 2. *Vigna mungo*, black gram 3. *Vigna radiata*, mung bean 4. *Vigna unguiculata*, cow pea
Horticulture	1. *Daucus carota* subsp. *sativus,* carrot 2. *Capsicum* sp. 3. *Moringa olifera*, drumstick 4. *Amaranthus gracilis*, green amaranth 5. *Trigonella foenum-graecum*, fenugreek 6. *Brassica oleracea*, Broccoli 7. *Artocarpus heterophyllus*, jackfruit

Overview and Scoping of the Availability and Potential of NUS in Bhutan

Mr Kailash Pradhan, Principal Research Officer from the Department of Agriculture at the Ministry of Agriculture and Forests in Bhutan, presented the scoping results on NUS in Bhutan. Bhutan is landlocked between India and China and its elevation variation is quite high. Land area is hilly, fragmented and isolated, and subsistence farming dominates. Rice is the major staple crop grown by 60 percent of farmers, followed by maize. Poverty rate is 12 percent and the country features only a narrow economic base as well as low productivity due to unfavourable terrain and fertility, and limited infrastructure. Bhutan is not self-sufficient in crops and depends on imports from other countries. With regard to malnutrition, stunting rates and anaemia among children are high. The potential of NUS has not yet been sufficiently tapped in the country because of globalisation and open trade, changing food preferences, as well as dependency and Government focus on rice. Mr Pradhan stressed the potential of NUS to contribute to food and nutritional security, conserve biodiversity, reduce imports and enhance household incomes. He based his prioritization of NUS on available resources in the country, potential for mainstreaming, integration into cropping systems, and competitive advantages. Buckwheat, for instance, was selected because of being traditionally and culturally important, and being a good source of energy, protein and micronutrients. The six prioritized NUS also include finger millet, barley, kidney bean, mung bean and lentil. At the end of his presentation, Mr Pradhan introduced some possible interventions for the way forward and emphasized the need to document local germplasm and knowledge of production systems, to introduce high yielding varieties, improve post-harvest management, exchange technical expertise, and develop capacity.

Dr Saharawat agreed to the list of proposed NUS. Based on the agro-ecological zones and dominant agricultural land use in Bhutan, he extended the list of potential NUS to four cereal species and five crops from the nuts and pulses group.

Dr Shetty provided data on malnutrition from the Global Nutrition Report (2016)[2]. A total of 33.6 percent of children in Bhutan are wasted, while anaemia and vitamin A deficiency account for 43.7 and 32.0 percent respectively. He agreed with the proposed crops from a nutritional perspective.

Dr Hussain pointed out that globalization and open trade were not discussed in the study, similar for demand of NUS. He indicated that processing of legumes has been limited so far, but opportunities for value adding exist. In terms of unfavourable agro-ecological conditions, other developing countries try to grow high value crops in low amounts as a cash crop, while importing high quantities of lower value crops. Preservation and diversification of local food systems, as well as local food storage are important for countries in mountainous regions because of their isolation.

Summary and Output Generation Based on Review of Discussants from a FAO Perspective

During the discussion, drumstick was suggested as potential crop, but Dr Pradhan pointed out that it is not culturally accepted. The same holds true for quinoa, which is now highly commercialized in many parts of the world, but is not a traditional crop in Bhutan. *Amaranthus* in turn, would be a better option. Based on the review and plenary discussion, experts agreed on the following NUS:

Table 8: Prioritized NUS in Bhutan sorted by food groups

Cereals	1. *Fagopyrum esculentum*, buckwheat 2. *Eleusine coracana*, finger millet 3. *Hordeum vulgare*, barley
Nuts and Pulses	1. *Phaseolus vulgaris*, kidney bean 2. *Vigna radiata*, mung bean 3. *Lens culinaris*, lentil

[2] International Food Policy Research Institute. 2016. Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030. Washington, DC.

Session 4: Use of GIS tool to capture NUS for targeted countries

Dr Bryan Boruff, Assistant Professor and Course Coordinator of the Masters of GIScience School of Earth and Environment at the University of Western Australia, held a presentation on "A geographic perspective on mapping neglected and underutilized crop species" with examples from Cambodia and Fiji. He identified various entry-points within agricultural systems for application of advanced technologies and highlighted the importance of mapping for visualisation. In his Fiji project, data was collected in several communities within a comprehensive approach, covering livelihood aspects, water, energy and food. He also introduced participatory mapping taking into account people and their social spheres, for example, how seasonal impacts, such as drought and flooding, influence certain communities. He gave an idea about remote sensing and explained that vegetation, including crops, have a signature reflection that can prove their presence and also indicate growing cycles. The major constraints for this technology though are cameras. They can only reflect as much information as their resolution allows. Especially for mosaic landscapes, where cultivation is scattered and small scale, mapping becomes less accurate. Recently, interest in drones has increased. For NUS, more detailed information and data will require more detailed work. Dr Boruff also pointed out that multi-methodological, multi-disciplinary and multi-scalar approaches are indispensable to identify NUS and ensure a wider adoption and implementation.

Dr Chandrashekhar M Biradar, Head of the Geoinformatics Unit at ICARDA, was absent during the meeting, but provided a presentation on application of GIS, which was kindly presented by his colleague Dr Saharawat. He showed that GIS can be used for mapping of agro-ecosystems and monitoring of sustainable agriculture in terms of land use, water productivity, crop yield, as well as dynamics of cropping intensity and patterns, such as identifying multiple cropping systems. To use mapping for NUS, more ground information will be required, including community-based approaches.

Session 5: Strategic Consideration on an Enabling Environment for NUS

Round Table 1: Strategies to Create an Enabling Environment to Tap Potentials of NUS to Address Malnutrition: A Policy Perspective

In Session 5, two rounds of panellists discussed two dimensions of an enabling environment for NUS. In Roundtable 1, Dr Prakash Shetty, Dr Abid Hussain, Dr Mohd Desa Haji Hassim, **Ms Khin Mar Oo** from the Ministry of Agriculture, Livestock and Irrigation in Myanmar, and **Mr Mahendra Nath Poudel** from the Ministry of Agricultural Development in Nepal focused on a policy perspective. They emphasised that there is a strong need to increase understanding and awareness of NUS and their importance for nutrition and climate resilience. Bridging the gaps between rural and urban people and influencing food system actors to introduce and promote NUS will be a major challenge. In this regard, consumer and farmer demand has to be build up from the ground, applying theory of change.

Preservation of varieties in gene banks and accessibility by farmers to close gaps between conservation and utilization have to be enhanced. Most of NUS are not considered as priority commodities and people' perception of them being poor "people's food" impend the mainstreaming of NUS in relevant policies. There is need to change these perception and promote and educate people. National research and agriculture extension randomly include NUS in their programmes. Sustainable seed supply systems are the contributing barriers for further promoting NUS.

Often, policy makers emphasize on the profit (income) generated from farm produce. They believe in numbers, and due to the low yields of NUS, these crops have been heavily neglected. The panel discussants suggested to identify and prioritize few crops including all the barriers mentioned above. Raising awareness of farmers on the benefits of NUS in terms of yield, income potential and climate resilience.

In order to promote NUS, they need to be included in national policy priorities such as climate change and strategies on biodiversity. There have been numerous comments on monocultures in the countries, and neither staples such as rice and wheat will give answers to the challenge of malnutrition. A case has to be made for NUS: communicating NUS benefits and sharing results from successful case studies with policy makers. First, science needs to convince policy makers to generate credibility. For a start, the outcomes of the Expert Consultation should be shared at ministerial meetings for promoting NUS and influencing national policies.

Considering that policy makers are the key players, there is need to convince decisions makers at all levels by indicating social and economic costs of hunger and malnutrition. The assessment of socio-economic perspectives of NUS will be important, especially to address policy and decision makers who are involved in national planning and finance. There is also need to create demand for NUS by consumers, to develop markets and further influence national policies. At the initial stage, further mainstreaming of NUS should be based on country-specific, small scale pilots focusing on only a few high-potential crops.

The responsibilities and topics in ministries are often scattered and collaboration is scarce. For NUS, a national high level body and/or a single agency should be defined to coordinate different sectors, ministries and stakeholders. A high-level committee is needed to bring these together and make high-level political commitments for promotion of NUS. These commitments should also apply to all development partners, including donors for resource mobilization. Multisectoral and multidimensional strategies are required for promoting NUS and inter-sectoral mechanism should be in place. Besides agriculture, nutrition, health and environment, other sectors may include education and involvement of women unions.

Security of land tenure will play an important part in promoting NUS. Also, marketing aspects should not be overlooked. Supportive policies are needed to incentivize small-holder farmers for producing and cultivating NUS. In this regard, a champion or supporter will be an effective mean to reach farmers and consumers, and advocate for NUS. Enabling policies may include crop insurance, subsidies, output-based incentives, support prices, and other measures, or may directly target specific groups, such as indigenous people and smallholders. Benefit sharing within local communities as well as incentives for growing NUS are also important aspects. Nevertheless, subsidies should only be seen as a spark, as they do not provide for long-term sustainability of a system. Development of procurement and distribution systems need to be considered as a consecutive step.

It will be indispensable to link policy making with research and development. Policies are needed to help the public sector to support NUS in terms of national research programmes. Tax incentives will help the private sectors to invest in production of NUS. Partnership with the private sector as well as provision of additional funding systems should be looked into. NUS awareness can also be created by mainstreaming indigenous knowledge and traditional recipes. Here, the private sector can also play a role by including NUS into their products and apply branding. Documentation of indigenous knowledge, recipes and even promotion via social media, TV programmes etc. can create a wide scope of interest. Promotion of NUS may be successful when focusing on health aspects, but need to be evidence-based. Mainstreaming NUS in national programmes such as school meal schemes and introducing them in education programmes are very important entry points that policies can address. Grass root level promotion is important, especially involving front line workers for promoting NUS.

When introducing NUS, it should not be overlooked which impacts on staple crops will be created. Inclusion should be done gradually. Rather than replacing staple crops, NUS should be part of holistic crop diversification strategies in the countries.

Round Table 2: Strategies to expand Utilization and promotion of NUS to Address Malnutrition in the Region: A Technical Perspective

The second roundtable covered technical acpects with regard to promotion of NUS. Panellists included **Dr Suhas P Wani**, Dr Shankar B Dandin, **Dr Eric Huttner**, Research Programme Manager for Crop Improvement and Management from the Australian Centre for International Agricultural Research, **Ms Nomin Bayasgalanbat**, Nutrition Officer from FAO RAP, Dr Kynet Kong and Dr Bryan Boruff. It was suggested to call NUS "Future Smart Food (FSF)" in the future to remove the negative stigma attached. The panellists agreed that neglected or underutilized crops should not be the name for these promising crops in the future. The term should point out their benefits, such as being climate-smart.

One idea for NUS promotion was to invite famous chefs, such as Jamie Oliver, to get involved in community kitchens and show the benefits and fun of cooking and integrating NUS/FSF into recipes. To reach young consumers, collaboration with popular food chains, such as McDonalds could be considered. Nationwide campaigns could help to advocate NUS, including TV and radio shows, but also including them into school curricula.

NUS are climate-resilient and rich in nutrients. If we find a market for NUS and ensure income generation, farmers will be willing to include NUS into their farming systems. Farmers need to learn

about production technologies and postharvest handling when producing NUS. If farmers can produce their own seeds or planting material, growing NUS, will become easier, marketable and profitable. In order to show the nutritional value of NUS, enough evidence needs to be created. Awareness on NUS can be created by first showing their nutritional value, second, market them by adding value and using a brand image, and last, to place them at suitable locations, such as food fairs. It was also suggested to produce a short, but comprehensive onepager about NUS, including their nutritional value and photos, and mainstream them though health professionals. Educating consumers, producers, processors, marketers and traders on the health benefit of NUS is a key prerequisite.

In order to increase consumption and marketing of NUS, NUS need to get into public procurement systems, like school feeding. Initial incentives for production of NUS are a must. NUS also need to be made attractive in terms of their appearances and value addition, e.g. processing them to ready-to-cook/eat food products and extend their shelf life. NUS need to be made attractive to young people by using targeted campaigns. How do large corporations achieve this? How do they create diversified marketing strategies? It was again stressed that a coordinator or champion should be identified, otherwise NUS will be no one's responsibility.

Consistent food composition tables are very important, especially at national level. Nutrition labelling for identified crops can help to improve the use of NUS, and provide for more safety and quality. Some people do not read labels. Therefore, campaigns and spokespersons are needed to promote NUS. NUS development needs to start from grassroots level, following a holistic value chain approach. Standardization and accreditation system of NUS should be considered. From a spatial perspective, more information on NUS is needed to close technical gaps. The same holds true for risk analysis. Knowledge gaps exist from soil to plate in NUS. Evidence on NUS benefits as well as traditional and indigenous knowledge are available, but poorly documented and disconnected from scientific evidence. We need to work with health organizations at global and country level to provide clinical evidence.

Considering where NUS grow, their climate-resilient potential shows. They grow in water-logged plots, in both upland and lowland, and many are drought-tolerant. Further evidence on their superiority in marginal areas, will help to enhance their integration into cropping systems. Some crops are considered as NUS, even if they are not climate-resilient. Some of them do not exhibit a significant nutritional value. Therefore, a critical review is needed.

The key will be to reach the right target groups and raise the popularity of NUS. They are not to replace staples, but complement them. The idea of a simple falafel sandwich covers this concept: The bean in the falafel is rich in protein and well-complements the wheat-based bread.

IV. Recommendations and Way Forward

Hunger, food insecurity and malnutrition are major challenges in the 21st century for Asia and the Pacific region. To achieve zero hunger, which stands at the core of the Sustainable Development Goals (SDGs), we need to improve dietary patterns and food systems urgently. Stakeholders in the agriculture and food value chain are affected by a disconnect between production, consumption, and nutrition. Agricultural diversification and resilience offer enormous opportunities for addressing hunger and malnutrition especially in the context of climate change. In this regard, Neglected and Underutilized Crop Species (NUS)[3] offer diverse and nutritious food resources. NUS are important in specific agro-ecological niches and often linked with the tradition and cultural heritage in their places of origin. They are an essential source of protein and micronutrients, enhance climate resilience, improve agriculture sustainability and boost household income and livelihoods with considerable commercial potential.

In this context, FAO, in collaboration with a number of national and international partners, organized a Regional Expert Consultation on Scoping, Prioritizing and Mapping of NUS held in Bangkok from 3–5 December 2016. Thirty-five participants, representing eight countries, as well as 22 national and international partners attended the Consultation and made the following recommendations.

1. Urgent call for decision-makers to raise awareness of the nutrition-sensitive and climate-resilient benefits of NUS to address hunger, malnutrition and climate change.
2. Recognize, identify and promote the complementarities of NUS with existing staple crops for nutrition enhancement, climate change resilience and diversification of cropping systems, and relabel NUS as "**Future Smart Food (FSF)**" to popularize these species.
3. Establish a National Coordinating Committee on FSF involving concerned ministries and appoint a Strategic Coordinator at the inter-ministerial level.
4. Create an enabling environment by strengthening national institutional support for mainstreaming FSF into national policies and programmes, by means of appropriate incentives, procurement of FSF for food programmes (e.g. mid-day meal/school meal scheme) to enhance national consumption, local production and facilitate marketing.
5. Establish nationally coordinated research for development programmes targeting FSF with high potential, and expand coverage of national agriculture statistics and national food composition data on FSF for evidence-based decision making.
6. Document and validate best-bet FSF case studies, compile indigenous knowledge related to FSF, undertake clinical and field studies to demonstrate the health benefits and climate resilience of FSF and assemble quantitative data for public dissemination.
7. Enhance public awareness of the importance of FSF by developing nutrition and climate change education materials and curricula on the importance of FSF for consumers, traders, producers, health professionals, researchers, teachers (e.g. school curricula), farmers, women and youth.

[3] "Neglected and underutilized species are those to which little attention is paid or which are entirely ignored by agricultural researchers, plant breeders and policymakers. They are wild or semi-domesticated varieties and non-timber forest species that are not typically traded as commodities." PADULOSI, THOMPSON AND RUDEBJER (2013)

8. Identify key entry points in the value chain and encourage value chain development for specific NUS, including innovative and targeted interventions for promotion (e.g. ready-to-use food products) and increased funds for research, development and extension capacities on FSF production and processing technologies.
9. Strengthen multidisciplinary and multi-sectoral collaboration through existing coordination mechanisms and build partnerships at national and regional levels, including academia, civil society and the private sector, to enhance research and consumption and to attract the private sector to boost production, processing, value addition, product development, and marketing of FSF.
10. Establish a regionally coordinated network on FSF to facilitate exchanging information, policy, technologies and genetic resources as well as FSF promotion in target countries.

Appendix

Annex 1 – Concept Note

Regional Expert Consultation on Scoping, Prioritizing and Mapping of Crop-related Neglected and Underutilized Species in Asia

Regional Initiative on Zero Hunger Challenge

Regional Office for Asia and the Pacific, FAO

Bangkok, Thailand, 3-5 December 2016

1. Background and Justification

1.1. Problems

Hunger, food insecurity and malnutrition is a major problem in Asia and the Pacific region. In 2014, around 490 million people are still undernourished in Asia and the Pacific (62 percent of the world's total), out of which 281 million in the Southern Asia sub-region. It is estimated that 93 million children under age of five are still stunted in the region, out of which 68 million are in the Southern Asia sub-region. The micronutrient deficiencies remain widespread in many countries in South-East Asia and South Asia.

Agriculture and nutrition are intrinsically linked. Most people in developing countries rely on agriculture for their employment, income and livelihoods. Poorly nourished people tend to lack the physical capacity to expand the agriculture production; poor households lack sufficient income access to adequate quantity and quality of diversified food to meet nutritional requirement. To achieve the overarching goal of reducing hunger and malnutrition, it is necessary to coordinate and integrate agriculture and nutrition actions to maximize impact. There is a need for better linkages between production, consumption and nutrition to tackle malnutrition and its causes. Dietary diversification is a cost-effective, affordable and sustainable means of strengthening local food systems and reducing hunger and malnutrition.

Recognizing the complex range of factors that contribute to hunger and malnutrition, recent reviews have also called attention to the need to focus on multisectoral approach to addressing malnutrition and to ensure that the agriculture production strategies lead to improving and diversifying diets through production diversification and promoting crops that have better nutritional qualities.

1.2. Gaps to Be Addressed

There is high prevalence of malnutrition accompanied by low dietary and production diversity in selected countries:

- Malnutrition – high prevalence of micronutrient deficiencies

The most recent data indicate that many countries have a high incidence of anaemia among pregnant women and children. For instance, among under five-year-olds 55 percent suffer from anemia in Cambodia, 51 percent in Nepal, 42 percent in Lao PDR and 40 percent in Myanmar. Not only anemia but also vitamin A and iodine deficiencies are high.

- Consumption – low dietary diversity

Dietary patterns in the selected countries show an overreliance on very few cereals (mainly rice) which represent 67 percent of the total daily dietary consumption in Myanmar, 72 percent in Nepal, 81 percent in Lao PDR and more than 75 percent in Cambodia. The consumption of vegetables and fruits also remain low. Thus the diet diversity indicators shows poor performance in selected counties.

- Production – low production diversity

75 percent of the total of agricultural households grow rice in Cambodia, 90 percent in Lao PDR and more than 50 percent in Nepal and Myanmar. Moreover, the recent growth of other cash crops such as sugar cane and cassava leading to low crop diversity in the farming systems.

In summary, high prevalence of malnutrition and low dietary and crop production diversity in these selected countries, reflects a common feature: disconnection on malnutrition, dietary diversity and production diversity, which requires a holistic and cost-effective intervention.

1.3. Justification: Potential of Crop-related Neglected and Underutilized Species

Agrobiodiversity offers huge potentials in addressing malnutrition and agricultural sustainability. Globally, approximately 30,000 edible plant species have been identified, of which more than 7,000 crop species have been used for food in the history of humanity. However, only 150 crop species are commercially cultivated and, of these, just 103 crops provide up to 90 percent of the calories in the human diet. Rice, wheat, maize and potato alone account for 60 percent of human energy supply. Furthermore, an ever increasing loss of biodiversity threatens the strength of our global ecosystems.

Neglected and Underutilized Species (NUS) are rich in Asia. They represent a promising abundance of food resources and constitute the bedrock of the food system diversity. Crops among NUS have many benefits and offers huge potentials. As an essential source of vitamins, micronutrients and protein, their nutritional value is high and may thus contribute to attain food security in the region. Besides nutrition value, they contains considerable commercial potentials and therefore contribute to household income generation and livelihood improvements. Furthermore, NUS crops contribute to climate-resilient and more sustainable food systems as they are frequently adapted to marginal conditions. A wider use of today's minor NUS crops may therefore make a great contribution to address malnutrition.

However, it is yet to scope the availability of crop-related NUS, prioritize and identify NUS with high potentials, and map the selected NUS for further development.

1.4. Priority-Setting exercise: 3-phase process

How to tap the high potentials of NUS that are widely available in selected countries? It needs to start with scoping, identification and prioritization of NUS. FAO, in collaboration with the University of Western Australia, ICARDA, ICRISAT, MSSRF-LANSA, CATAS-TCGRI, Mahidol University, ACIAR, ICIMOD, CFF, as well as national research institutes, intends to conduct an interdisciplinary priority-setting exercise that is composed of 3-phases:

1) <u>Stage 1: Scoping</u>
    - Prepare a preliminary scoping report on the availability of NUS at national level (see Annex 1 and Annex 2)
    - Share the preliminary scoping report for comment
    - Review the report by international institutions (prior to the Expert Consultation)
2) <u>Stage 2: Expert Consultation</u>
    - Validate the preliminary scoping report on NUS in the selected countries
    - Rank high-potential NUS based on established priority criteria
    - Identify 5-6 NUS crops per country

3) Stage 3: GIS Mapping

- Map high-potential NUS according to their geographical availability/prominence using GIS
- Prepare the GIS reports on selected crops per country

2. Objective of Expert Consultation

The objectives of the Regional Expert Consultation are to

a) Validate the preliminary scoping report on crop-related NUS in the selected countries

b) Rank and prioritize high-potential NUS based on established priority criteria

c) Identify 5-6 crop-related NUS per country.

d) Strategize to enhance productions and the utilisation of the selected crops in local diets.

3. Target food crops

It is proposed that target food crops focus on the following groups: cereals, roots and tubers, nuts and pulses, horticulture, and others.

4. Priority criteria

It is proposed that NUS be assessed according to the criteria as follows:

a)	Nutrition	➢ Nutritional value and health benefits
b)	Production Practices	➢ Local knowledge, availability and seasonality ➢ Productivity, intercropping and competing from other crops ➢ Processing
c)	Ecology	➢ Agroecology ➢ Adaptation to local climate and soil types
d)	Socio-Economic	➢ Cultural acceptance and consumer preferences ➢ Access to market and potential income generation

5. Partners & Contributors

- FAO
- Academia/International research institutes: The University of Western Australia, ICARDA, ICRISAT, MSSRF-LANSA, CATAS- TCGRI, Mahidol University, ACIAR, ICIMOD, CFF
- National research institutes in selected countries

6. Expected Outputs

a) Scoping of the availability of crop-related NUS in selected countries has been validated.

b) NUS crops have been assessed and prioritized according to a set of criteria.

c) 5-6 crop-related NUS per country have been identified for GIS mapping.

d) Strategies to enhance productions and the utilisation of the above selected crops in local diets has been discussed.

Annex 2 – Agenda

FAO Regional Initiative on Zero Hunger Challenge

Regional Expert Consultation on Scoping, Prioritizing and Mapping of Neglected and Underutilized Crop Species in Asia

In observance of International Year of Pulses

Co-sponsor: ACIAR

3-5 December 2016

Royal Princess Hotel Larn Luang, Bangkok, Thailand

In collaboration with the FAO Special Ambassador of the International Year of Pulses 2016, the University of Western Australia, the International Centre for Agricultural Research in the Dry Areas, the International Crops Research Institute for the Semi-Arid Tropics, Bioversity International, the M S Swaminathan Research Foundation - Leveraging Agriculture for Nutrition in South Asia, Mahidol University, the Chinese Academy of Tropical Agricultural Sciences - Tropical Crops Genetic Resources Institute, the International Centre for Integrated Mountain Development, Crops for the Future, the International Tropical Fruits Network, and The Akshaya Patra Foundation

DAY ONE		
Time	**Topic**	**Presenter/Discussant**
08:00-08:30	**Registration**	
Opening Session		
08:30	**Welcoming remarks by ADG/RR RAP, FAO**	**Dr Kundhavi Kadiresan, ADG/RR, FAO RAP**
08:40	Brief on the proceedings, objectives and expected outcome of the Consultation	Dr Xuan Li, Senior Policy Officer, RI-ZHC Delivery Manager, FAO RAP
08:50	Introduction of Participants	Brief self-introduction by all participants
09:10	Conceptualization on tapping potentials of NUS to address hunger and malnutrition: linking production diversity, dietary diversity and malnutrition	Dr Xuan Li, FAO RAP
09:30	**Keynote speech:** Importance, Challenges and Potential of Neglected and Underutilized Crops	**Dr Mahmoud Solh**
09:55	**Keynote speech**: Pulses contribution to production and dietary diversity to eradicate hunger and malnutrition	**Prof Kadambot Siddique,** FAO Special Ambassador IYP 2016, UWA
10:20-10.40	Q&A	Plenary
10:40-11:00	Group Photo and Tea/Coffee break	
Session 1: Setting the Scene: Enabling environment required for NUS to address hunger and malnutrition		
11:00	Neglected and Underutilized Crop Species: Challenges in relation to production, consumption, marketing	Prof Visith Chavasit, Mahidol University
11:20	Contributions of NUS to addressing hunger and malnutrition in mountainous areas	Dr Abid Hussain, ICIMOD
11:40	NUS development: what polices/incentives are required along the value chain?	Dr Mohd Desa Haji Hassim, TFNet
12:00-12:30	Q&A	

12:30-13:30	Lunch break	
13:30	Neglected and Underutilized Fruit Species – An insurance against global mal- and undernutrition	Dr. Shankar Bashettepa Dandin, BI
13:50	The Mid-day Meal Scheme – A Flagship Intervention of the Government of India	Mr Shridhar Venkat, The Akshaya Patra Foundation
14:10	Promoting nutrition-sensitive agriculture incorporating Neglected and Underutilized Crops: Lessons from LANSA Research	Dr Prakash Shetty, MSSRF-LANSA
14:30	Q&A	Plenary
15:00-15:30	Tea/Coffee break	
Session 2: Scoping, Validation and Prioritization of NUS – Country Group 1 Chair: Dr Xuan Li, FAO RAP and Prof Kadambot Siddique, FAO Special Ambassador IYP 2016		
Overview and Scoping of the Availability and Potential of NUS in Nepal		
15:30	Preliminary Scoping of NUS in Nepal	Dr Renuka Shrestha, NARC
16:00	Reviewing Preliminary Scoping Study on NUS in Nepal from **Agriculture/ Ecological** Perspectives: Presentation on Validation and Prioritization	Dr Yashpal Singh Saharawat, ICARDA Dr Suhas P. Wani, ICRISAT
16:15	Reviewing Preliminary Scoping Study on NUS in Nepal from **Nutrition** Perspective: Presentation on Validation and Prioritization	Dr Prakash Shetty, MSSRF-LANSA
16:30	Reviewing Preliminary Scoping Study on NUS in Nepal from **Socio-economic** Perspective	Dr Abid Hussain, ICIMOD
16:45-17:15	Discussions	Plenary
Summary and Output Generation Based on Review of Discussants from a FAO Perspective		
17:15	➢ Wrap up and Nomination of 5-6 priority NUS in Nepal	FAO RAP/FAO Special Ambassador for IYP 2016
17:35	Housekeeping	
18:00-20:00	**Welcome reception**	FAO RAP
DAY TWO		
08:30 08:40	• Recapturing of 1st day and brief on the 2nd day's programme	Chair: Dr Xuan Li, FAO RAP and Prof Kadambot Siddique, FAO Special Ambassador IYP 2016
Overview and Scoping of the Availability and Potential of NUS in Lao PDR		
08:40	Preliminary Scoping of NUS in Lao PDR	Dr Siviengkhek Phommalath, NAFRI
09:10	Reviewing Preliminary Scoping Study on NUS in Lao PDR from **Agriculture/ Ecological** Perspective: Presentation on Validation and Prioritization	Dr Suhas P. Wani, ICRISAT Dr. Li XU/Dr. Yuchun PANG, CATAS-TCGRI
09:25	Reviewing Preliminary Scoping Study on NUS in Lao PDR from **Nutrition** Perspective: Presentation on Validation and Prioritization	Dr Anadi Nitithamyong, Mahidol University
09:40	Reviewing Preliminary Scoping Study on NUS in Lao PDR from **Socio-economic** Perspective	Mr Max Herriman, CFF
10:00-10:30	Discussions	Plenary
10:30-11:00	Tea/Coffee break	
Summary and Output Generation Based on Review of Discussants from a FAO Perspective		
11:00	➢ Wrap up and Nomination of 5-6 priority NUS in Lao PDR	FAO RAP/FAO Special Ambassador IYP 2016
Overview and Scoping of the Availability and Potential of NUS in Cambodia		
11:20	Preliminary Scoping of NUS in Cambodia	Dr Kynet Kong, CARDI

11:50	Reviewing Preliminary Scoping Study on NUS in Cambodia from **Agriculture /Ecological** Perspective: Presentation on Validation and Prioritization	Dr. Li XU/Dr. Yuchun PANG, CATAS-TCGRI Dr Suhas P. Wani, ICRISAT
12:05	Reviewing Preliminary Scoping Study on NUS in Cambodia from **Nutrition** Perspective: Presentation on Validation and Prioritization	Dr Anadi Nitithamyong, Mahidol University
12:20-14:00	Lunch break	
14:00	Reviewing Preliminary Scoping Study on NUS in Cambodia from **Socio-economic** Perspective	Mr Max Herriman, CFF
14:20-14:50	Discussions	Plenary
Summary and Output Generation Based on Review of Discussants from a FAO Perspective		
14:50-15:10	➢ Wrap up and Nomination of 5-6 priority NUS in Cambodia	FAO RAP/FAO Special Ambassador IYP 2016
Overview and Scoping of the Availability and Potential of NUS in Myanmar		
15:10	Preliminary Scoping of NUS in Myanmar	Dr Minn San Thein, DAR
15:40	Reviewing Preliminary Scoping Study on NUS in Myanmar from **Agriculture/ Ecological** Perspective: Presentation on Validation and Prioritization	Dr Suhas P. Wani, ICRISAT Dr Shankar Bashettepa Dandin, BI
15:55	Reviewing Preliminary Scoping Study on NUS in Myanmar from **Nutrition** Perspective: Presentation on Validation and Prioritization	Dr Anadi Nitithamyong, Mahidol University
16:10-16:40	Tea/Coffee break	
16:40	Reviewing Preliminary Scoping Study on NUS in Myanmar from **Socio-economic** Perspective	Mr Max Herriman, CFF
17:00-17:30	Discussions	Plenary
Summary and Output Generation Based on Review of Discussants from a FAO Perspective		
17:30	➢ Wrap up and Nomination of 5-6 priority NUS in Myanmar	FAO RAP/FAO Special Ambassador IYP 2016
DAY THREE		
08:15	• Recapturing of 1st and 2nd day and brief on the 3rd day's programme	Chairs: Dr Xuan Li, FAO RAP and Prof Kadambot Siddique, FAO Special Ambassador IYP 2016
Session 3: Reviewing the State of the Art on NUS – Country Group 2 Chair: Dr Xuan Li, FAO RAP and Prof Kadambot Siddique, FAO Special Ambassador IYP 2016		
Overview and Scoping of the Availability and Potential of NUS in Vietnam		
08:20	Preliminary Scoping of NUS in Vietnam	Dr Pham Hung Cuong, Plant Resources Centre
08:35	Reviewing Preliminary Scoping Study on NUS in Vietnam from **Agriculture**/ **Ecological** Perspective	Dr Suhas P. Wani, ICRISAT Dr Shankar Bashettepa Dandin, BI
08:50	Reviewing Preliminary Scoping Study on NUS in Vietnam from **Nutrition** Perspective	Dr Anadi Nitithamyong, Mahidol University
09:05	Reviewing Preliminary Scoping Study on NUS in Vietnam from **Socio-economic** Perspective	Mr Max Herriman, CFF
09:15	General Discussion	Plenary
Overview and Scoping of the Availability and Potential of NUS in Bangladesh		
09:30	Preliminary Scoping of NUS in Bangladesh	Dr Md Amjad Hossain, BARI
09:45	Reviewing Preliminary Scoping Study on NUS in Bangladesh from **Agriculture**/**Ecological** Perspective	Dr Yashpal Singh Saharawat, ICARDA
10:00	Reviewing Preliminary Scoping Study on NUS in Bangladesh from **Nutrition** Perspective	Dr Prakash Shetty, MSSRF-LANSA

10:15	Reviewing Preliminary Scoping Study on NUS in Bangladesh from **Socio-economic** Perspective	Dr Abid Hussain, ICIMOD
10:25	General Discussion	Plenary
10:40-11:10	Tea/Coffee break	
Overview and Scoping of the Availability and Potential of NUS in West Bengal, India		
11:25	Preliminary Scoping of NUS in West Bengal, India	Dr Apurba Chowdhury, UBKV
11:40	Reviewing Preliminary Scoping Study on NUS in West Bengal, India from **Agriculture**/ **Ecological** Perspective	Dr Yashpal Singh Saharawat, ICARDA
11:55	Reviewing Preliminary Scoping Study on NUS in West Bengal, India from **Nutrition** Perspective	Dr Prakash Shetty, MSSRF-LANSA
12:10	Reviewing Preliminary Scoping Study on NUS in West Bengal, India from **Socio-economic** Perspective	Dr Abid Hussain, ICIMOD
12:20	General Discussion	Plenary
Overview and Scoping of the Availability and Potential of NUS in Bhutan		
12:35	Preliminary Scoping of NUS in Bhutan	Mr Kailash Pradhan, CoRRB
12:50	Reviewing Preliminary Scoping Study on NUS in Bhutan from **Agriculture**/ **Ecological** Perspective	Dr Yashpal Singh Saharawat, ICARDA
13:05	Reviewing Preliminary Scoping Study on NUS in Bhutan from **Nutrition** Perspective	Dr Prakash Shetty, MSSRF-LANSA
13:20	Reviewing Preliminary Scoping Study on NUS in Bhutan from **Socio-economic** Perspective	Dr Abid Hussain, ICIMOD
13:30	General Discussion	Plenary
13:45-14:45	Lunch break	
Session 4: Use of GIS tool to capture NUS for targeted countries		
14:45	Potentials of Geoinformatics application in mapping food and nutritional security	Dr Chandrashekhar M. Biradar, ICARDA
15:25	A geographic perspective on mapping neglected and underutilised crop species: examples from Cambodia and Fiji	Dr Bryan Boruff, UWA
15:45	Q&A	Plenary
Session 5: Strategic Consideration on an Enabling Environment for NUS − Recommendations and Way Forward		
16:00	**Roundtable 1:** Strategies to Create Enabling Environment to Tap Potentials of NUS to Address Malnutrition: A Policy Perspective **Chairs**: Dr Xuan Li and Dr Mahmoud Solh **Panellists**: Dr Prakash Shetty, MSSRF-LANSA; Dr Abid Hussain, ICIMOD; Dr Mohd Desa Haji Hassim, TFNet; Ms Khin Mar Oo, MoALI, Myanmar; Mr Mahendra Nath Poudel, MoAD, Nepal	Panel
16:45-17:15	Tea/Coffee break	
17:15	**Roundtable 2:** Strategies to Expand Utilization and Promotion of NUS to Address Malnutrition in the Region: A Technical Perspective **Chairs**: Dr Xuan Li and Prof Kadambot Siddique, FAO Special Ambassador IYP 2016 **Panelists**: Dr Suhas P Wani, ICRISAT; Dr Shankar B Dandin, BI; Dr. Eric Huttner, ACIAR; Ms. Nomin Bayasgalanbat, FAO; Dr Bryan Boruff, UWA; Dr Kynet Kong, CARDI, Cambodia	Panel
18:00	**Recommendations and Way Forward**	Dr Xuan Li, FAO RAP and Prof Kadambot Siddique, FAO Special Ambassador IYP 2016
18:20	**Closing remarks**	Ms Xiangjun Yao, RSPC, FAO RAP

Annex 3 – Welcoming Remarks

FOOD AND AGRICUTURE ORGANIZATION (FAO)
OF
THE UNITED NATIONS

WELCOMING REMARKS

Kundhavi Kadiresan
Assistant Director-General and Regional Representative
Regional Office for Asia and the Pacific

Excellency, distinguished Participants, Colleagues,

Ladies and Gentlemen,

Good morning to you all!

I would like to give my appreciation to the Special Ambassador for the International Year of Pulses for FAO and also Dr Mahmoud Solh. This is a real pleasure to have you with us – and also all the experts and senior officials from various governments here in the region as well as from other parts of the world. This is absolutely a special event. Unfortunately, it is on a long weekend, otherwise you would have had a lot more people from FAO as well as other senior officials from the Government here in Thailand as well.

I want to take this opportunity to first warmly welcome all of you, and I would also like to thank you for your participation in the Regional Expert Consultation on Scoping, Prioritizing and Mapping Neglected and Underutilized Crop Species in Asia. This is a very important area that we, in the FAO Regional Office, have started to focus on. A lot of it had been owed to our work in the region. It has in fact really shown that a lot more needs to be done in the area of hunger and malnutrition.

As we look around the countries in this diverse region, we see a lot of good results and a region that has, overall, reduced hunger by half in just 25 years. But at the same time, when we try to dig deeper, we also see that hunger and poor nutrition continue to exist in a serious way in the region. As we speak, we have close to 490 million hungry people in this region, perhaps close to 60 percent globally hungry and malnourished in this part of the world. So we have a lot of work to do. There is no time for complacency.

But what can we do more? We can observe high levels of stunting and micronutrient deficiency, while at the same time there is also growing incidence of obesity in many countries. That's alarming and another area of concern that we need to watch carefully. Particularly in the Pacific Islands, it is starting to show and in some countries in the region as well. So overall, when we talk about malnutrition, it is not just about not having enough to eat. Whenever I travel to countries in the region, the

governments and ministers are asking: Are they eating the right food and is there a good balanced diet? Because the issues arising, such as high blood pressure and diabetes, are showing up among the population, which is a serious concern to governments as well.

So, in order to achieve Zero Hunger, which stands at the core of the SDGs, we need to improve dietary patterns and food systems. We need to realize that many people are consuming too little of nutritious foods that are good for us, and that too much food is being produced without offering enough choice – and often because of the policies that governments pursue. We need to recognize that stakeholders along the agriculture and food value chain are affected by a disconnect between production and consumption pattern, and knowledge about nutrition, which results in a poor overall nutritional status among too many people.

Now what has gone wrong? There is something that this group can actually help with, not only trying to understand what the issues are, but also try to find meaningful solutions. One factor is a lack of diversification and overconcentration on a few staple crops. In Asia, this is rice, in Africa, it is maize, which dominates our diets in particular. Just look at some of the numbers: Rice accounts for 67 percent of the total daily food consumption in Myanmar, 72 percent in Nepal, more than 75 percent in Cambodia and in Lao PDR 81 percent. These are real numbers coming from our countries in the region. While rice fills the stomach, a rice-dominated diet provides for only low to no amounts of protein, amino acids and essential micronutrients, which can be, for instance, found in pulses, fruits, nuts, tubers, vegetables, fish, meat, and edible insects. What most of the people in the bottom ladder see, is rice.

So in some sense, we really need to pay a lot of attention in terms of understanding, what are the reasons for this focus on one or two food items. A heavy reliance on rice can also contribute to vitamin A, iron, and zinc deficiencies, resulting in serious illnesses in the population. I don't need to explain, you are all the experts! **Therefore:** If we are to achieve the SDG target, business-as-usual is NOT the way to go in managing our food systems.

What could be solutions? Neglected and underutilized crops offer high potential and that is the main theme of the next three days. Apart from their superior nutritional qualities, many of these crops do not require high inputs, and can be grown in marginal lands and easily intercropped or rotated with staple crops. We all talk about the climate agenda very much these days and often, it is these crops which increase agrobiodiversity and improve soil quality, thus contributing to a better environment. Rediscovering their value, providing tailor-made policies and technical support for their wider application, post-harvest and value chain development, will help to alleviate malnutrition and bring back diversity to the diets of millions.

Building on previous knowledge on neglected crops generated by FAO and in light of celebrating the 2016 International Year of Pulses, I would like to highlight the outstanding potential of underutilized pulse crops on agriculture, nutrition, ecological and socio-economic contributions. Pulses are hardy crops and show wide adaptation to diverse climates and cropping systems. I am sure, we will hear more from our Special Ambassador on the International Year of Pulses later. What I want to emphasize is that neglected crops are a hidden treasure. They offer not only potential, but also real solutions for more nutrition-sensitive, climate-resilient and social-economically sustainable agriculture.

Traditional food systems in Asia have developed over hundreds of years, featuring a wide abundance of crops. But: their importance in modern society has been declining and is now considered neglected. We need to recognize that preference and policy support provided for cash crops or mono-cropping have driven that transition. It has led to the situation today that many of the region's neglected species are no longer found in the agricultural sphere, but in the region's forests and wetlands. The disconnect within the current agriculture and food systems is a systematic and multidimensional problem – often not an easy one to solve, right? It requires interdisciplinary solutions which start with identification of right Neglected and Underutilized Crop Species for prioritization in the country.

Distinguished guests and colleagues.

As we can see, we have our work cut out for us. This event in the next three days should not just focus on the issues, but actually on how we move forward to better vary the diets of millions across this region. And as I said, rice is actually an obsession in this region. Everyone follows the direction of the politicians, especially the farmers, who respond to the policies of governments. If you put more subsidy in a particular crop – which is rice, most often – everybody grows rice. If you consider rice fertilization policies of the Government, everybody grows rice. In the countries, people talked with so much passion about those staple crops.

So in some sense, it is not only talk about the political and technical dimensions of it. As experts, you are also coming from your own country, weighing the socio-cultural aspects of it. Why do these things happen? What is your good advice how to break the cycle? To break the cycle is never easy. We often need to get to the heart of the politicians and it is the most difficult part, is it not? But at the same time, we can also find ways: Who are the leaders in their country, who can actually reach out to the larger majority of the population?

I also have to say that people are not just needing rice. When you look at the dietary pattern and at the other types of food that are being consumed, you see that people are starting to consume vegetables and fruits, and that mixing actually has increased. But again, is it happening across the population, particularly the poorest of the poor? Because they are the ones who need to be addressed by not only policies and programmes. We also need to have data awareness as well as access and the ability to buy, for instance, vegetables or fruits. Are these foods available to them at reasonable prices, so that they can actually consume them?

What is more important than anything else are knowledge and awareness. Especially when feeding infants, we need a good mix of carbohydrates, proteins, fats and essential micronutrients, so that children, when they are growing up, have that. Awareness needs to be build. That does not have to be just left to the politicians. Even though the policies may be secured, we can still influence cultural practices and social habits that are, more often than not, trying to emphasize on balanced diets in the countries. Maybe you can also help us to try and find good interventions in the scaling. I very much look forward to your recommendations and a set of suggestions for us to move forward.

First, I would like to give credit to the governments on Zero Hunger and national research institutes on the preparation of national scoping studies that were conducted well in advance of the Consultation. We got a series of things planned under this regional programme. First, preparing the

scoping study: Now you have all come here to give us some good country-specific and regional understanding, and hopefully prioritize what kind of policies and programmes we should pursue.

Secondly, I am very impressed by the long list of international partners on board with shared vision in this noble mission. Neglected and Underutilized Crop Species is a multi-disciplinary subject. Without your strong and continuous commitments and dedications, rediscovering the hidden treasure of the Neglected and Underutilized Crop Species would not be possible. I would like to give special thanks and acknowledgement to the FAO Special Ambassador for the International Year of Pulses, Professor Kadambot Siddique, who has been providing intellectual support to the Consultation. I also want to acknowledge the strong commitment and engagements from ICARDA and Dr Mahmoud Solh who emphasized on the shared vision between ICARDA and FAO and common challenges of countries on Zero Hunger in the region. I also want to thank the Australian Centre for International Agricultural Research for your financial contribution to this event.

Thirdly, I hope this Consultation will not only help countries to identify priority Neglected and Underutilized Crop Species candidates that are nutrition-sensitive and climate-smart, but also to be able to identify policy and technical constraints – and not only technical constraints, but also socio-cultural habits – that prevent a comeback of neglected crops in farmers' fields and on our tables. I look forward to further evidence-based studies, such as using the latest technologies to advise governments. Let's work together, building a strong network and to support governments to formulate national crop diversification strategies that are nutrition-sensitive and climate-smart!

I will keep a close eye in terms of the key recommendations coming from this event, and I will be also having a launch of FAO's State of Food Insecurity in the Asia and Pacific region next week on Tuesday. I hope some of you, if you are still staying here, will attend. I want to really make sure that the brainstorming you are going to have within the next three days, and the recommendations coming from this, would actually help us to share with the participants in that larger event. More than anything else, we, as FAO need to take this forward in a very practical and strong way, not just talking about the issues, but how we really help governments and other stakeholders in the policies and programmes to make a difference.

I wish you all a successful meeting and look forward to the outcomes of the Consultation. I hope, this is just the beginning of a further collaboration with you all in the regional work that we plan to do in the next twelve to eighteen months.

I thank you all. Please also have a good time in Thailand. It is such a beautiful country, and it is also a good time of the year.

Thank you all!

Annex 4 – List of Partners

i. Australian Centre for International Agricultural Research (ACIAR)
ii. Bangladesh Agriculture Research Institute (BARI)
iii. Bioversity International (BI)
iv. Cambodian Agricultural Research and Development Institute (CARDI)
v. Chinese Academy of Tropical Agricultural Sciences- Tropical Crops Genetic Resources Institute (CATAS-TCGRI)
vi. Crops for the Future (CFF)
vii. Department of Agriculture, Ministry of Agriculture and Forests, Bhutan
viii. Department of Agricultural Research (DAR), Myanmar
ix. Food and Agriculture Organization of the United Nations (FAO)
x. FAO Special Ambassador for International Year of Pulses 2016
xi. International Centre for Agricultural Research in the Dry Areas (ICARDA)
xii. International Centre for Integrated Mountain Development (ICIMOD)
xiii. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
xiv. International Tropical Fruits Network (TFNet)
xv. Mahidol University, Thailand
xvi. M S Swaminathan Research Foundation - Leveraging Agriculture for Nutrition in South Asia (MSSRF-LANSA)
xvii. National Agriculture and Forestry Research Institute (NAFRI), Lao PDR
xviii. Nepal Agriculture Research Council (NARC)
xix. Plant Resources Centre (PRC), Vietnam
xx. The Akshaya Patra Foundation, India
xxi. The University of Western Australia (UWA)
xxii. Uttar Banga Krishi Viswavidyalaya (UBKV), West Bengal, India

Annex 5 – List of Participants

The University of Western Australia

Prof Kadambot Siddique
FAO Special Ambassador of the International Year of Pulses
Hackett Professor of Agriculture Chair and Director at the UWA Institute of Agriculture

Dr Bryan J Boruff
Assistant Professor and Course Coordinator Masters of GIScience School of Earth and Environment

ICARDA

Dr Mahmoud Solh
Former Director General
Lebanon

Dr Yashpal Singh Saharawat
Senior Agronomist
Country Manager Afghanistan

Dr Chandrashekhar Biradar
Head of Geoinformatics Unit
Lebanon

ICRISAT

Dr Suhas P Wani
Research Programme Director, Asia
Director of ICRISAT Development Centre
India

ACIAR, Australia

Dr Eric Huttner
Research Programme Manager for Crop Improvement and Management

Bioversity International

Dr Shankar B Dandin
Liaison Officer Project Office, Bengaluru
India

MSSRF-LANSA

Prof Prakash Shetty
Chief Executive Officer
LANSA Research Programme Consortium

Mahidol University, Thailand

Dr Anadi Nitithamyong
Assistant Professor
Institute of Nutrition

Prof Visith Chavasit
Ex-Director & Professor
Institute of Nutrition

Ms Weeraya Karnpanit
Researcher
Institute of Nutrition

ICIMOD, Nepal

Dr Abid Hussain
Food Security Economist, Livelihoods

Crops for the Future, **Malaysia**

Mr Max Herriman
Unit Head, Advisory and Consulting Services
Research Programme Director FishPLUS

TCGRI-CATAS, China

Dr Yu Xin Pang
Researcher / Director

Dr Li Xu
Professor

TFNet, Malaysia

Dr Mohd Desa Hassim
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The Akshaya Patra Foundation, India

Mr Shridhar Venkat
Chief Executive Officer

Cambodia

Dr Kynet Kong
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Cambodian Agricultural Research and Development Institute

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Deputy Director General
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Legume Researcher
National Agriculture and Forestry Research Institute

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Ms Khin Mar Oo
Deputy Director
Ministry of Agriculture, Livestock and Irrigation

Dr Minn San Thein
Deputy Director and Head
Myanmar Seed Bank
Department of Agricultural Research

Nepal

Mr Mahendra Nath Poudel
Senior Agriculture Economist
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Dr Renuka Shrestha
Chief of Agronomy Division
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Mr Kailash Pradhan
Principal Research Officer
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Ministry of Agriculture and Forests

Bangladesh

Dr Md Amjad Hossain
Director
Training and Communication Wing
Bangladesh Agriculture Research Institute

Vietnam

Dr Cuong Pham Hung
Deputy Director General
Plant Resources Centre

West Bengal, India

Dr Apurba Chowdhury
Professor and Ex-Dean
Uttar Banga Krishi Viswavidyalaya

FAO RAP

Dr Kundhavi Kadiresan
Assistant Director-General and Regional Representative

Ms Xiangjun Yao
Regional Strategic Programmes Coordinator

Dr Xuan Li
Senior Policy Officer
RI-Zero Hunger Challenge Delivery Manager

Ms Isabell Piroth
Food Security and Nutrition Consultant

Ms Nomin Bayasgalanbat
Nutrition Officer

Ms Amgalan Ariunbold
Plant Production Consultant

Ms Melina Lamkowsky
Consultant

Annex 6 – Closing Remarks

FOOD AND AGRICUTURE ORGANIZATION (FAO)

OF

THE UNITED NATIONS

CLOSING REMARKS

Xiangjun Yao
Regional Strategic Programme Coordinator
Regional Office for Asia and the Pacific

Distinguished Guest,

Colleagues,

Ladies and Gentlemen,

It is my great honour and pleasure to have the opportunity of delivering the closing remarks for this Regional Expert Consultation on Scoping, Prioritizing and Mapping of Neglected and Underutilized Crop Species in selected countries in Asia.

Let me once again, on behalf of the Food and Agriculture Organization of the United Nations, thank all participants for their great contributions, guidance and interactive discussions that made this meeting successful.

I believe that the discussions you had in the past three days have provided adequate opportunity to increase understanding of the crucial role of indigenous and traditional crops that are often neglected and underutilized. Moreover, you also have validated the preliminary scoping reports on NUS in a total of eight countries and you have identified key crops with high potential for promoting further in each country.

Distinguished participants,

Our current production focus on less than a handful of staple crops leads to dietary imbalance and its direct cause is malnutrition. In order to address this issue, our food systems must be diversified. An easy, feasible and low-cost intervention is the introduction of Neglected and Underutilized Crop Species that not only diversify agricultural landscapes and the fields of our farmers, but also increase diversity on our plates. Many segments of the region's population are still unaware of the health benefits of consuming these traditional and indigenous crops and there is still inadequate information regarding their potential. Due to the lack of appropriate production practices and technologies, insufficient government attention, poor infrastructure including storage facilities and transportation, as well as weak market and consumer demand, Neglected and Underutilized Crop Species have until now remained a hidden treasure . To unlock their full potential with regard to availability and use, further research investment is needed to explore crosscutting issues, including differences in

socioeconomic status, cooking practices and consumer preferences, agro-ecological conditions and economic benefits. Documentation of existing agrobiodiversity resources and traditional knowledge associated with cultivation, collection and preparation of indigenous traditional foods in different eco-geographical zones is indispensable.

Research can only be translated into action when surrounded by an enabling environment. Different national policies and strategies related to agriculture, forestry, natural resource management, food security, rural development, trade and nutrition should consider the importance of neglected and underutilized crops and must be supportive of promoting their production and consumption for reducing hunger and malnutrition. Neglected and Underutilized Crops have to be part of national development strategies, allowing for targeted interventions with adequate funding and investment in national programmes. There is a strong need to raise public awareness about the health and nutritional value of these crops. The broad range of modern, available media options can contribute to increase the knowledge and interest of farmers and consumers.

In addition to awareness raising, cross-sectoral regional and national multi-stakeholder platforms need to be developed and further strengthened for engaging representatives from multiple disciplines, including, agriculture, biodiversity forestry, nutrition, health and education, to promote neglected and underutilized species.

Ladies and Gentlemen,

I am grateful for the efforts taken by the distinguished national and international experts in identifying key recommendations for taking actions and agreeing on the way forward. I am confident that this this meeting has just been the start of our long journey on this joint mission. Through collaboration of various stakeholders and good partnership with all of you, we will be able to implement the plans and deliberations emanating from this meeting.

Finally, let me extend my sincere appreciations to all participants, country teams, distinguished experts and facilitators whom I believe had significant contributions to the success of this meeting.

Let me once more, thank you all for your active participation and I wish you all a safe journey back home.

Thank you.

Annex 7 – Written Messages Addressed by Mr Savanh Hanephom, Lao PDR

Regional Expert Consultation on Scoping, Prioritizing and Mapping of Crop-related Neglected and Underutilized Species in Asia

Regional Initiative on Zero Hunger Challenge

Regional Office for Asia and the Pacific, FAO

Bangkok, Thailand, 3-5 December 2016

Some talking points relevant to Lao PDR

A large part of rural populations in Lao PDR face food insecurity and malnutrition despite being often surrounded by extraordinary biodiversity, including neglected and underutilized species (NUS). Low quality diets are common and the risk of micronutrient deficiencies is high. Food Security is often seen as the amount of energy available from staple food production, but the quality of diets in terms of nutrients and food components is, in Lao PDR, the main factor contribution to malnutrition, and then should be better taken into account.

The Government increasingly recognizes the role of agro-biodiversity and NUS in their contributions to sustainable food and nutrition security. In Lao PDR for example, our national Sub Sector Working Group on Agro biodiversity (chaired by the Ministry of Agriculture and Forestry and co-chaired by the FAO) covers this topic well. We also have developed a national Agro biodiversity program and have various ongoing projects focusing on NUS (including plant and animal resource).

The integration of NUS in development projects contributes substantially to Food and Nutrition Security in numerous ways. In Laos in particular, NUS serve as safety net in times of food shortage and contribute to resilience against food insecurity by improving the nutritional status of poor households. Our strategy for village forest protection aims to protect natural resource for NUS and our national nutrition strategy aims to promote food production and food consumption diversification. NUS in Lao PDR also contribute a lot to income generation and to empowerment of women.

We find important to change the perception of NUS from "poor man's food" to "rich and unique food". For that we need to raise awareness on their economic value, for example through the promotion of protected geographical indications. In relation to their nutritional value we believe that public awareness campaigns, better information and training can help farmers and consumers realize the benefits NUS can bring and can encourage policy makers to optimize and promote these benefits.

It is true that we have focused a lot the major commodity crops (food and non-food crop) and they remain very important, but the shift to a more integrated has started.

We need to train farmers and other groups along value chains. This is particularly important for women as it empowers them to play an important role in taking NUS to markets. Broadening agricultural curricula and extension services mandate to include the conservation and use of NUS along with the staple crops has also encouraged all relevant stakeholders along the value chain to better bring food and nutritional approaches to agricultural development.

Actually, addressing challenges, needs and opportunities related to promoting NUS calls for active collaboration with local communities and mainstreaming gender-sensitive approaches. Farmer and mass organizations can also help making programs to promote the relevance and effectiveness of NUS more effective.

Our development partners have assisted a lot through research on the nutritional aspects of NUS, and their adaptive traits, which we find very important because in Lao PDR we want to involve the full range of stakeholders in participatory partnerships to promote and conserve NUS.

Linking with other sectors will also help promoting NUS as key priorities in marketing NUS are improving access to markets, adding value and stimulating demand.

In Lao PDR, we want to strengthen the existing collaborations in promoting, conserving and sustainably using NUS through multi stakeholder approaches and platforms across sectors. We have strengthened cooperation among stakeholders and created synergies but coordination to promote NUS at different levels and in different areas will keep establishing common approaches.

We warmly welcome this FAO initiative because the current lack of interaction across sectors (agriculture, nutrition, health, environment, education) and stakeholder groups (farmers, researchers, value chain actors, and decision makers) limits the potential of NUS. Mechanisms and processes that facilitate strategic synergies among national, regional and international networks, and collaborative platforms, need to be encouraged and supported.