Regional Workshop on Implementation of Suwon Agrobiodiversity Framework

PROCEEDINGS

4-6 November 2011, Kuala Lumpur, Malaysia

Organized by

Asia-Pacific Association of Agricultural Research Institutions (APAARI)
and
Bioversity International

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The Organizers

APAARI (Asia-Pacific Association of Agricultural Research Institutions) is a regional association that aims to promote the development of NARS in the Asia-Pacific region through inter-regional and inter-institutional cooperation. The overall objectives of the Association are to foster the development of agricultural research in the Asia-Pacific region so as to : promote the exchange of scientific and technical information, encourage collaborative research, promote human resource development, build up organizational and management capabilities of member institutions and strengthen cross-linkages and networking among diverse stakeholders. To meet these needs, the Association: i) convenes General Assembly once in two years, holds regular Executive meetings yearly and organizes consultations, workshops, trainings etc, ii) collects, collates and disseminates research findings, iii) maintains links with other fora in the region and outside through meetings/ participation and information exchange, and iv) promotes need based collaboration in research projects among member institutions, analyzing priorities and focusing on regional agricultural development. For details, please visit: //www.apaari.org/

Bioversity International is an independent international scientific organization that seeks to improve the well-being of present and future generations of people by enhancing conservation and the deployment of agricultural biodiversity on farms and in forests. It is one of 15 centers supported by the Consultative Group on International Agricultural Research (CGIAR), an association of public and private members who support efforts to mobilize cutting- edge science to reduce hunger and poverty, improve human nutrition and health, and protect the environment. Bioversity has its headquarters in Maccarese, near Rome, Italy, with offices in more than 20 other countries worldwide. The institute operates through four programmes: Diversity for Livelihoods, Understanding and Managing Biodiversity, Global Partnerships, and Commodities for Livelihoods. Financial support for Bioversity's research is provided by more than 150 donors, including governments, private foundations and international organizations. For details of donors and research activities, please see Bioversity's Annual Reports, which are available in printed form on request from bioversity-publications@cgiar.org or from Bioversity's website (www.bioversityinternational.org).

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Foreword

During 2010, being the International Year of Biodiversity, APAARI and its stakeholders in the Asia-Pacific region adopted the Suwon Agrobiodiversity Framework that shows the way forward towards the sustainable management and use of agrobiodiversity, equitable access and benefit sharing of genetic resources, and evoking required awareness concerning genetic resource management through regional collaboration and partnerships among stakeholders. The recommendations embodied in the framework need to be translated into action by the respective countries and organizations and build on the momentum for future agrobiodiversity research and development activities in the region.

We are delighted that to implement the recommendations of the Suwon Agrobiodiversity Framework, APAARI and Bioversity International, in collaboration with GFAR, FAO and ADB organized this follow-up "Regional Workshop on the Implementation of Suwon Agrobiodiversity Framework through Strengthened Regional Collaboration" at Kuala Lumpur on 4-6 November, 2011. We are glad that the workshop further developed and refined the regional road map for implementing the framework and strengthened networking and collaboration among various stakeholders in the Asia-Pacific region. We are extremely happy that during the workshop, several projects have been identified as regional priorities for further development into concept notes and full project proposals.

We also note with great interest and appreciation the continuing involvement of various stakeholders in pursuing the implementation of Suwon Agrobiodiversity Framework and acknowledge with thanks the active involvement in this workshop of NARS from Malaysia, India, Indonesia, the Philippines, Vietnam, Cambodia, South Korea and China, NGOs like the Local Initiatives for Biodiversity, Research and Development (LI-BIRD) and Asian NGO Coalition (ANGOC), and international organizations (FAO, IRRI, Bioversity International, ICRAF, ICRISAT). We are grateful to ADB, GFAR and FAO for providing financial support that enabled us to organize the workshop and MARDI for co-hosting the event.

The Suwon Agrobiodiversity Framework is a useful mechanism for mainstreaming important regional initiatives that aim to strengthen the conservation and use of agricultural biodiversity. It is also useful in influencing policy makers on specific policies and targeted interventions to counter the loss of agrobiodiversity. It is an important and useful guide in developing national programs which can propel activities with maximum impact.

The discussions and recommendations from this very important workshop are presented in this publication which will be immensely useful to policy makers, research managers, development agencies, and even the farmers and students. We hope that the proceedings will be strategically disseminated to the relevant stakeholders and used to generate awareness on the much needed actions to be taken for the implementation of the Suwon Agrobiodiversity Framework.

Leocadio S. Sebastian
Regional Director, APO
Bioversity International

Raj Paroda
Executive Secretary
APAARI

Acronyms and Abbreviations

ADB	Asian Development Bank
AFACI	Asian Food and Agriculture Cooperation Initiative
ANGOC	Asian NGO Coalition
APAARI	Asia-Pacific Association of Agricultural Research Institutions
APO	Asia, the Pacific and Oceania
AVRDC	Asian Vegetable Research and Development Center (now World Vegetable Center)
CAB	Commonwealth Agricultural Bureaux
CARDI	Cambodian Agricultural Research and Development Institute
CBD	Convention on Biological Diversity
CBM	Community Biodiversity Management
CBOs	Community Based Organizations
CCS	Complementary Conservation Strategy
CCIs	Cross-Cutting Issues
CFF	Crops for the Future
CIFOR	Center for International Forestry Research
CGIAR	Consultative Group on International Agricultural Research
CoP	Conference of Parties
CRPs	CGIAR Research Programmes
CSOs	Civil Society Organizations
CWR	Crop Wild Relatives
ES	Ecosystem Services
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GFAR	Global Forum on Agricultural Research

GCDT	Global Crop Diversity Trust
GIPB	Global Partnership Initiative for Plant Breeding
GR	Genetic Resources
ICOPRI	Indonesian Coconut and Palmae Research Institute
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICABIOGRAD	Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development
ICRAF	World Agroforestry Center
INBAR	International Network for Bamboo and Rattan
IPCC	Inter-Governmental Panel on Climate Change
IPR	International Property Rights
IPBES	Inter-Governmental Platform on Biodiversity and Ecosystem Services
IRRI	International Rice Research Institute
ITCC	International Technology Cooperation Center
IUCN	International Union for Conservation of Nature
LI-BIRD	Local Initiatives for Biodiversity, Research and Development
MARDI	Malaysian Agricultural Research and Development Institute
NARES	National Agricultural Research and Extension Systems
NARS	National Agricultural Research System
NGOs	Non-Government Organizations
NUS	Neglected and Underutilized Species
PES	Payment for Environmental Services
PGRFA	Plant Genetic Resources for Food and Agriculture
RDA	Rural Development Administration
R&D	Research and Development
SSC-IUCN	International Union for Conservation of Nature/Species Survival Commission
SWOT	Strengths, Weaknesses, Opportunities and Threats
UPLB	University of the Philippines, Los Baños

Regional Workshop on Implementation of Suwon Agrobiodiversity Framework

Summary of Workshop

The regional workshop on the 'Implementation of Suwon Agrobiodiversity Framework' was organized at Kuala Lumpur, Malaysia from 4-6 November, 2012 and attended by 44 experts and resource persons representing various stakeholder groups in the Asia-Pacific region actively engaged in agrobiodiversity research for development. The participants came from various NARS (Malaysia, India, Indonesia, the Philippines, Vietnam, Cambodia and China), non-government organizations [Local Initiatives for Biodiversity, Research and Development (LI-BIRD) and Asian NGO Coalition (ANGOC)], and international organizations (FAO, IRRI, Bioversity, ICRAF, ICRISAT). The discussions focused on three important areas that were identified in the Suwon Agrobiodiversity Framework, viz, 1) Application of strategies and technologies to enhance *in situ* and *ex situ* conservation through use with the goal of enhancing livelihood and reducing poverty; 2) Assessment of the agrobiodiversity richness and status relative to economic, social and cultural factors; and 3) Interdisciplinary studies on interactions between agricultural and wild ecosystems, and ecosystem services for agriculture. As a result of extensive consultations and intense discussions among the stakeholders present, the workshop successfully identified five regional projects in the three thematic areas for further development into concept notes and full project proposals.

The workshop was organized and funded by APAARI and Bioversity International. Additional funding was provided by the Global Forum on Agricultural Research (GFAR), Food and Agriculture Organization of the United Nations (FAO), and Asian Development Bank (ADB). The Malaysian Agricultural Research and Development Institute (MARDI) and Bioversity International Regional Office for Asia, the Pacific and Oceania (APO) served as hosts, while the International Rice Research Institute (IRRI), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), World Agroforestry Center (ICRAF) and Crops for the Future (CFF) were sponsors of the event. The array of organizations involved in the workshop reflected the strong interest and partnership in coming up with regional collaborative projects in line with the Suwon Agrobiodiversity Framework.

Background

During the International Symposium on “Sustainable Agricultural Development and Use of Agrobiodiversity in the Asia-Pacific Region” which was held in Suwon, Republic of Korea, from 13-15 October, 2010, the participants adopted the agrobiodiversity framework for the Asia-Pacific Region known as “Suwon Agrobiodiversity Framework”. The Framework has also been endorsed by Asia-Pacific Association of Agricultural Research Institutions (APAARI) and supported by Global Forum on Agricultural Research (GFAR). The Framework reflected the recognition by the participants from the national agricultural research extension systems (NARES) and from regional and international

organizations on the importance of collective efforts towards the conservation through use of the rapidly declining agricultural biodiversity in the region. It provides a strategic approach, towards the sustainable management and use of agrobiodiversity through regional collaboration and partnerships among stakeholders. It also identifies the areas of research and development (R&D) and regional collaboration that will help maximize resources and opportunities for more agile response to new and unforeseen developments in understanding diversity and promoting research, conservation, evaluation and documentation through use. Moreover, it serves as a holistic guideline, encompassing the concerns and needs of stakeholders across Asia-Pacific. In view of this, the Framework recommendations are expected to be translated into action by the respective countries and organizations and build on the momentum for future agrobiodiversity R&D in the region.

As a follow-up to this very important development, a workshop was successfully organized from 4-6 November, 2011 at Kuala Lumpur, Malaysia which was aimed at developing a proposal for regional collaborative activities in line with the focus areas identified in the Framework.

Objectives of Workshop

- To develop a regional Road Map for implementing the Suwon Agrobiodiversity Framework and strengthening networking and collaboration among various stakeholders in the Asia-Pacific
- To develop regional collaborative projects based on the Suwon Agrobiodiversity Framework and in line with prospective donors priorities on the following areas:
    - ❖ Application of strategies and technologies to enhance *in situ* and *ex situ* conservation through use with the goal of enhancing livelihood and reducing poverty
    - ❖ Assessment of the agrobiodiversity richness and status relative to economic, social and cultural factors
    - ❖ Interdisciplinary studies on interactions between agricultural and wild ecosystems, and ecosystem services for agriculture
- To identify countries participating in the project, their role and the focal persons
- To identify and link up with possible funding organizations

Opening Session

Chief Guest : *YB. Datuk Abd. Shukor Abd. Rahman*, Director General, Malaysian Agricultural Research and Development Institute (MARDI)

Dr. Bhag Mal, Consultant APAARI delivered the welcome address for the workshop on behalf of Dr. Raj Paroda, Executive Secretary, APAARI. On behalf of APAARI, he welcomed the chief guest and all the participants present. He expressed his heartfelt gratitude to MARDI for graciously agreeing to host the first day program. He reiterated that international and regional agencies, Civil Society Organizations (CSOs), private sector, and regional networks have a crucial role to play in strengthening agrobiodiversity conservation and use in the Asia-Pacific region. Enhanced collaboration between national and international research institutions and the civil society would help in the holistic understanding and importance of agrobiodiversity. He expressed extreme satisfaction with the programme of the workshop which he commended as very well structured with plenary presentations on each of the main themes identified followed by group discussions and further added that the intense discussions during two day workshop will result in streamlining strategies for research and development in the region and moving

forward in implementing the Suwon Agrobiodiversity Framework and come up with draft concept notes for some well conceived projects to be funded by donors.

The Chief Guest Datuk Dr. Abd. Shukor Abd. Rahman inaugurated the workshop. He congratulated the organizing committee for their efforts in organizing the workshop. He mentioned that this particular event is historic for MARDI and Malaysia as it marks an important milestone in Malaysia's global efforts on agrobiodiversity conservation and sustainable utilization, especially working in partnership amongst the Asia-Pacific countries. He stressed on many issues to be addressed and that the Suwon Agrobiodiversity Framework will serve as a guideline to channel future research and collaboration.

Dr. Leocadio Sebastian, Regional Director for Asia, the Pacific and Oceania, Bioversity International, delivered the vote of thanks on behalf of APAARI and Bioversity International. He expressed the importance of moving forward with the Asia-Pacific framework for agrobiodiversity which was endorsed by the region through APAARI in 2010. He thanked Datuk Dr. Abd. Shukor Abd. Rahman for kindly accepting the invitation to grace the occasion and give the inaugural address despite his very hectic schedule. Dr. Sebastian expressed his gratitude to Dr. Raj Paroda, Executive Secretary, APAARI, for setting the tone of this workshop with his remarks which were delivered by Dr. Bhag Mal. In closing, Dr. Sebastian wished the participants fruitful discussion sessions and hoped that the workshop outputs will lead to greater regional collaboration.

Plenary 1. Agrobiodiversity Agenda in the CGIAR Research Agenda

Speaker: *Dr. Kwesi Atta-Krah*, Deputy Director General, Bioversity International

Dr. Kwesi Atta-Krah, in his plenary presentation on "Agrobiodiversity agenda in the CGIAR research agenda" reviewed the role and place of genetic resources in the CGIAR and its reform process. The new CGIAR strategy and its results framework were outlined and summarized from 15 Independent Centers to one Consortium with 7 thematic areas of work, to the creation of 15 CGIAR Research Programs (CRPs) which will now address 4 development outcomes. Agricultural biodiversity has been identified as the key resource in ensuring CGIAR outcomes which include food and nutrition security, system resilience, poverty eradication, and climate change.

The speaker noted that in the international symposium held in 2010, some questions were raised on whether any vital genetic resources research or research-support programs were missing from the CGIAR portfolio of CRPs. The CGIAR Consortium Board requested a study known as the Genetic Resources Scoping Study, to investigate if genetic resources research and conservation activities were sufficiently incorporated in the CRPs, whether there were genetic resources-related cross-cutting issues that had not been addressed or had been duplicated in several CRPs. The study identified relevant cross-cutting issues (CCIs - activities common to two or more CRPs) in genetic resources and noted that the highest priority CCIs with respect to GR were in the areas of: technology needs for GR, informatics needs for GR and policy issues for GR. The study found that a number of cross-cutting research and other issues relevant to the conservation and use of agricultural biodiversity were not adequately covered in the current CRPs where the CGIAR should undertake work.

Relevant examples of the different genetic resources research themes in the CRPs were aptly presented. Additional elements to the cross-cutting GR components were also touched upon. The speaker reiterated that the CGIAR is well-positioned to ensure the availability of diversity for genetic improvement and optimising diversity in production systems.

Plenary 2. Applying strategies and technologies to enhance *in situ* and *ex situ* conservation through use with the goal of enhancing livelihood and reducing poverty

Speaker : *Dr. Prem Mathur*, South Asia Coordinator and Senior Scientist, Diversity Assessment and Use, Bioversity International

The presentation made by Dr. Prem Mathur provided substantial information briefly describing the various challenges for food security which included population growth, land degradation, yield stagnation and climate change amongst others while reiterating the importance of agricultural biodiversity to global food security. Dr. Mathur highlighted that without doubt the success of present day agriculture is an outcome of the green revolution, which has resulted in food security. However, the speaker added that at the same time, green revolution has also resulted in simplification of agricultural production systems, where the bulk of the global agricultural production is now coming from the cultivation of fewer species and even from use of limited varieties from the less cultivated crop species.

One of the major problems associated with the green revolution is the narrowing species diversity in agrobiodiversity. It was indicated that there are about 400,000 plant species world-wide, out of which 300,000 species have been documented in some form of their existence and of these about 30,000 plant species are edible and can be used as source for food security. However, from these large number of edible plant species, only 7,000 species have so far been utilized at different levels of consumption, but there are no statistical records for their cultivation. The statistical records for the cultivation of edible species is only available for about 200 species of which only 30 species feed the majority of the world population. But 56% of global food production comes from only three crops, rice, wheat and maize. Other negative consequences included the loss of environmental services, for example, natural control of pests and diseases due to loss of biological control agents; since the concentration is only for a few species for food production, many important species are neglected and some of these now become endangered; most of the farmers' varieties have been replaced by high yielding varieties causing genetic erosion and threat to useful diversity; this has also resulted in the disappearance of many genes contributing to resistance to biotic and abiotic stresses as well as to quality and nutrition component of our diets. These eventually lead to the increased vulnerability towards pests and diseases.

These challenges can be addressed by capturing the full range of these traits contained in the diversity of species and varieties through collecting, systematic characterization and evaluation and making the information associated with these useful and potential diversity to breeders, researchers and others, who can use it to enhance the quantity and quality of agricultural products.

The two common methods of conservation were brought into focus: *in situ* and *ex situ* conservation. The various conservation strategies were illustrated. The future sustainable agriculture production can only be possible through enhanced use of plant genetic resources, both conserved *ex situ* and available *in situ*/on-farm. It is necessary that the existing diversity should be made available in the form required by the users. To achieve this, a clear strategy and commitment is needed, which is presently lacking at all levels.

The speaker then proceeded to discuss the possible ways which can promote or enhance the use of genetic resources to address the various challenges faced for food security. The role

of biotechnology was also discussed with the speaker adding that biotechnology can play a significant role in promoting use for genetic resources since these tools allow for measuring biodiversity and direct selection of genotypes. Various successful case studies from CGIAR centers were presented.

Plenary 3. Assessment of the agrobiodiversity richness and status relative to economic, social and cultural factors

Speaker : *Dr. Mauricio Bellon*, Programme Director, Diversity and Livelihoods Programme, Bioversity International

The presentation made by Dr. Mauricio Bellon highlighted the value of crop diversity citing the two dimensions: i) diversity among cultivated species (inter-specific diversity), and ii) diversity within a species (infra-specific diversity). A simple model was presented on how farmers maintained intra-specific diversity. The question of why farmers abandon crop intra-specific diversity was briefly addressed with the conventional explanation for this loss that farmers do not want to continue to plant a diverse set of varieties (particularly landraces) because of high yielding varieties, specialization within the crop, diversification to other crops, non-farm labour opportunities and migration. Some factors which were associated with the decrease in crop diversity included environmental heterogeneity, consumer and cultural preference. Ways of supporting farmers in the maintenance of crop intra-specific diversity and associated genetic diversity were discussed. Some of the practical solutions include rewards to maintain crop diversity, eliminate perverse incentives that may eliminate crop diversity without enhancing farmers' wellbeing and create mechanisms that recognize and reward farmers for maintaining crop diversity. Interventions were proposed to enhance the multi-functionality of the crop of interest increasing the value of local crop varieties for farmers who may otherwise stop growing them.

Plenary 4. Interactions between agricultural and wild ecosystems, and ecosystem services for agriculture

Speaker : *Meine van Noordwijk*, Chief Science Advisor, World Agroforestry Center

In his keynote presentation, Dr Meine van Noordwijk encouraged the participants to think of land uses and ecosystem service provision through integration rather than segregation of uses. In reality, there is no clear boundary between agricultural and wild ecosystems, but rather a long gradient and overlapping of land uses for different purposes. In Southeast Asia, for example, half of agricultural land has more than 30% of tree cover. Definitions of forest are contested, with many competing definitions emphasizing biophysical, functional or political aspects, and different people having very different definitions for the same land. Definitions of forest often interfere with local people's rights to manage and use land. A more comprehensive approach to the provision of goods and ecosystem services in the landscape is needed. Agricultural ecosystems should be widely understood as any systems which produce goods and services to support peoples' livelihoods, and their capacity to provide a multitude of ecosystem services while sustaining the immediate livelihood needs must be recognized. Such recognition should include studying and developing approaches for rewarding people for maintaining and managing the provision of ecosystem services, whose benefits extend beyond the local context and have regional and global importance.

Plenary 5. Development opportunity crops initiative towards diversification in agriculture

Speaker : *Dr. Michael Hermann*, Global Coordinator, Crops for the Future

Dr. Hermann provided an overview of the Development Opportunity Crops Initiative towards diversification in agriculture, an initiative which was founded by AVRDC-The World Vegetable Center, Bioversity International, Crops for the Future, Global Horticulture Initiative, Global Forum for Agricultural Research, International Network for Bamboo and Rattan (INBAR) and Plant Resources of Tropical Africa. The various stakeholders of this initiative included the Global Forum on Agricultural Research, regional and sub-regional organizations and their relevant initiatives, CGIAR Centers and emerging consortium research programmes, international centers, organizations and initiatives, national research and/or development organizations, NGOs/CBOs and the private sector. This multi-stakeholder platform was formed as there was an urgent need to initiate solid and inclusive projects to build concerted and practical actions on sustainable use; mobilize regional and international action in support of national needs and strengthen evidence base for wider commitment and actions. Dr. Hermann also summarized the three pillars behind the initiative which include: i) food security, nutrition and health; ii) source of income and resilience of farming systems, and iii) environmental services. Various case studies were presented to better illustrate the need for this important initiative.

Plenary 6. Funding opportunities

Speaker : *Dr. Kakoli Ghosh*, Team Leader, Seeds and Plant Genetic Resources, Plant Production and Protection Division, FAO

Dr. Ghosh provided an analysis of emerging trends regarding funding opportunities in the area of Plant Genetic Resources for Food and Agriculture (PGRFA). She described FAO's role in PGRFA and seeds which covered a range of pertinent areas including policy and technical support as a global forum for PGRFA, seeds and related aspects; advocacy; awareness and partnerships amongst others. Highlighting the current financial crisis which has shaken many traditional donors, she emphasized that the demand for country ownership seems to be on the rise. Donors now seek projects which show immediate impact with new and non-traditional donors coming on board. In general, agriculture which includes agrobiodiversity, research and development and extension largely remain underfunded and unrecognized. She stressed the importance for projects to show improved linkages using a more integrated approach.

Plenary 7. Collaborative opportunities under the Asian Food and Agriculture Cooperation Initiative (AFACI)

Speaker : *Dr. Haeng-hoon*, *Kim*, Rural Development Administration (RDA), Republic of Korea Senior Seconded Scientist to Bioversity International

Dr. Kim introduced the Asian Food and Agriculture Cooperation Initiative to the participants on behalf of the International Technology Cooperation Center (ITCC), of Rural Development Administration (RDA). AFACI was inaugurated in 2009 with the intent of establishing an agricultural cooperation network in Asia, promoting close international collaboration, sharing the technology and experiences and contributing to sustainable agriculture and food security. AFACI aims to elevate the livelihood of people through the innovation and share of agricultural technology

contributing economic development, sustainable agriculture and food security among the member countries. With an annual budget of US$ 2.2 million, a total of 15 projects are currently being implemented across Asia. Dr. Kim briefly described the projects which were being undertaken. He concluded his presentation by encouraging workshop participants to pursue collaboration with AFACI and become a member which would be a worthwhile contribution to the pursuit of the agrobiodiversity agenda in the Asia region.

Structure of Group Discussions

The first day afternoon session was devoted to break-up sessions to brainstorm on the three areas and identify priorities or narrow down on possible proposals to be developed. The second day started with a plenary with the groups presenting the output of their discussions. This was followed by a question and answer session. During this time, participants provided inputs on other groups' outputs. The group discussions focused on developing the objectives of the proposed projects. This was followed by group discussions on the possible approaches, methodology, and project outputs. The final discussions for the day focused on small group discussion to refine the group outputs, identify prospective partners, assign tasks for future follow-ups, and other matters. The closing ceremony was held in the afternoon of the second day. The third day was devoted to discussions by smaller group of participants to finalize the concept notes.

Group 1. Application of strategies and technologies to enhance *in situ* and *ex situ* conservation through use with the goal of enhancing livelihood and reducing poverty

Facilitator : *Dr. Prem Mathur*

Members:

Dr. Haeng Hoon Kim
Dr. Tiur Sudiaty
Dr. Fiona Hay
Dr. M. Dutta
Ms. Kwek Mei Jiun
Dr. Salma Idris
Dr. Michael Hermann
Dr. Bhag Mal
Dr. H.D. Upadhyaya
Dr. Nestor Altoveros
Ms. Bernadette Joven

It was agreed that the concept note developed should have a regional context and should be doable, realistic and with a time frame. The importance of feasibility to get funding was emphasized while discussing about the topic and the objective to the likely project. Besides, the type of crops and the countries to be involved were also among the main factors discussed while designing the project.

A list of crops was generated through brain-storming among the group members. Major crops such as rice and maize were mentioned as they still provide food security globally. Other commercial crops like coconut, banana and soybean were also discussed as they are regionally important and suitable for short-term project. The importance of indigenous crops such as chickpea,

pigeonpea and pearl millet to India was addressed, especially for pearl millet which has less adaptation to climate change (drought). Tuber crops such as taro and yam are underutilized in Cambodia. Besides, vegetables like eggplant, pulses like pea and bean were mentioned as well. Industrial crops such as tea was mentioned but rejected in view of the importance of food crops to be prioritized for research.

Issues like too much focus being given to genebank management were raised. The idea of teaming up project with breeders or agronomists was well received.

After intense discussions, the outlines for 3 proposed projects were consequently developed as follows:

Project 1: Enhance utilization of germplasm for optimizing use of water, nutrients, saline soils and pesticides for sustainable crop production

Possible titles

1. Enhancing utilization of germplasm for optimizing resource use and climate adaptation for improved crop production and livelihoods
2. Enhancing utilization of genetic resources for optimizing resource use and climate adaptation for improved crop production and livelihoods
3. Enhancing utilization of germplasm for optimizing use of water, nutrients, saline soils and pesticides for sustainable crop production

Background

- The rich genetic diversity of priority crops in the target region, including specific nations
- Diverse climatic conditions
- Agricultural constraints faced due to climate change in the region, in general, and their impacts on priority crops
- Use of crop diversity to manage risks arising due to climate change
- Significance of the priority crops in terms of food security and nutrition and improving livelihoods
- Migration of people from agriculture to urban sector
- Importance of optimizing resource use like water, nutrients, saline soil
- Increased demand for quality products
- Status of national programmes for enhancing utilization

Rationale

- Less exploitation of genetic resources for crop improvement
- Narrow genetic base of existing cultivars/varieties

- Need for climate resilient varieties/genotypes
- Satisfy varied market demands
- Lack of capacity building initiatives among partners
- Rising problems of new pests and diseases, salinity, drought, flood, degraded soils, etc.

Objectives

- To develop appropriate representative subsets (core and/or minicore) of priority crops
- To identify trait specific genetically diverse and agronomically desirable (if possible) germplasm for key traits for use in crop improvement to develop cultivars with a broad genetic base
- To enhance capabilities of national partners on various aspects of germplasm conservation, characterization/evaluation and utilization

Methodology

A. Crops with available minicore subsets (chickpea, pearl millet, pigeonpea, peanut)

- ❖ Identification of trait specific germplasm
- ❖ Agronomic evaluation of core subsets in NARS for traits of interest
- ❖ Use of trait specific genetically diverse and agronomically desirable (if possible) germplasm identified from the minicore collections and other confirmed sources
- ❖ Capacity building

B. Crops without available subsets

- ❖ Characterization and evaluation for traits of interest
- ❖ Development of core and minicore subsets, if appropriate
- ❖ Agronomic evaluation of core subsets in NARS for traits of interest
- ❖ Use of trait specific genetically diverse and agronomically desirable (if possible) germplasm identified from the minicore collections and other confirmed sources
- ❖ Capacity building

Project 2: Acquisition and accessing of crop wild relatives and accessing novel alleles for enhanced use

Alternative title

Accessing novel alleles from CWR for poverty alleviation in the context of climate change/ sustainable use/livelihood

Crops : *Rice, mungbean, eggplant, soybean, *wheat, pigeonpea, chickpea, groundnut, etc.

Rationale

- Livelihood (poverty alleviation, benefits to society), climate change adaptation, and enhanced use of PGR
- Environmental resilience
- Acquisition and accessing of crop wild relatives (CWR), unused CWR in the region or outside the region
- Accessing novel alleles from CWR
- Addressing the core of the project for all of these situations

Background

- Poverty situation in Asia-Pacific, nutrition
- Environmental degradation/climate change
- Gene pools, discussion on CWR
- Genetic erosion in CWR

Objectives

- Understanding the genetic diversity of CWR
- Enhancing the availability and security of CWR
- Locating novel alleles for deployment in crop improvement

Methodology

- Systematic gap analysis and mapping CWR diversity for future collections and acquisition
- Identify sources with higher level of resistance for the abiotic and biotic stresses and quality traits
- Identify useful and novel alleles for traits of importance
- Enhance capacity of national partners for utilization and conservation of CWR

Project 3: Enhancing use of underutilized species for improved livelihoods and diversified diets

Background/Rationale

Abandonment of traditional lifestyles and increasing globalization of trade and food systems have tended to favour only a few major crops and these have come to dominate agricultural as well

**Also being covered by GCDT CWR project*

as horticultural production, value-adding and commerce. Funding of agricultural research and development has concentrated primarily on these commodities. As a result, a large number of food species have fallen into disuse and have been replaced by the major crops and the products derived from them. However, these neglected and underused plant species are part of a rich cultural and food diversity. Many species have the potential to play a much more important role than they do today in sustaining livelihoods and human wellbeing and in enhancing ecosystem health and stability. In addition, agrobiodiversity helps to keep options open for adaptation to climate change and other future challenges.

The proposed project is in response to the need of promoting underutilized species in the general context of diversifying current production and food systems in poor communities in Asia. The project has been developed within the priorities for agrobiodiversity conservation and use established by the Suwon Framework of Agrobiodiversity, and during a stakeholder workshop in Malaysia in 2011.

Main objective

Improve livelihoods of poor people through greater use of neglected and underutilized species (NUS) in nutrition and income generation

Specific objectives

- Improve access to information on neglected crops
- Expand the demand for NUS through greater consumer awareness
- Enable farmers to improve linkages to markets
- Enhance availability of germplasm with desirable attributes
- Strengthen capacities of national programmes to undertake research on neglected crops
- Advocacy of favourable policy environment

Crops (tentative)

- Non-cereal grains (nutritious millets, buckwheat, quinoa, amaranth), roots and tubers, fruits and vegetables, essential oils and other specialty species

Methodology

- Survey and mapping at regional and national levels for priority crops and their diversity
- Identification of use constraints and market opportunities
- Collection/acquisition and evaluation of germplasm for market potential in diverse eco-climatic conditions
- Conservation of germplasm (*in situ* and *ex situ*)
- Document traditional knowledge regarding the use of priority crops
- Protection (IPR) of farmer products through geographic indications, collective trademarks – needs to be clarified for further discussion

Group 2. Assessment of the agrobiodiversity richness and status relative to economic, social and cultural factors

Facilitator : *Dr. Ram Rana*

Members:

Dr. Shukri Ali	Dr. T.Y. Channa
Fr. Francis Lucas	Dr. Susan Rivera
Dr. Hengky Novarianto	Dr. Bai Keyu
Dr. Mauricio Bellon	Dr. Peter Ooi
Mr. Lim Eng Siang	Ms. Dorothy Chandrabalan

Before the actual workshop, a framework for discussion was prepared by the facilitator and distributed to the members for their inputs. In the framework, the following issues were highlighted:

1. Assessing richness, evenness and divergence of agrobiodiversity in a given household, community, landscape level (unit of measurement)
    - Should we aim for high evenness with moderate richness for addressing negative impact of uniformity?
    - Should we aim for high community divergence of PGRFA for community resilience-against climatic adversity, market and other forces?
2. Socioeconomic factors
    - What are the socioeconomic factors that influence management of agrobiodiversity on-farm?
    - Which socioeconomic factors play key positive role in the management of agrobiodiversity on-farm?
3. Cultural/religious factors
    - How cultural diversity is associated with agrobiodiversity?
    - What are cultural driving forces that support management of local diversity?
    - How landraces with sociocultural and religious values be marketed for promoting agrobiodiversity conservation on-farm?
4. Market forces
    - Can market forces play some role in conservation of agricultural biodiversity on-farm?
    - How to assure markets work for conservation of landraces with unique traits?
    - What would be the incentive mechanism for market to play positive role in conservation?

- What are strategies that support co-existence of commercialization and diversity-oriented management?

5. Network and custodian farmers
    - How custodian farmers who maintain rich diversity (crops and knowledge) on-farm, are distributed in different communities?
    - What are the characteristics of custodian farmers who maintain rich diversity on-farm?
    - What motivates custodian farmers to maintain and exchange rich diversity between farms and beyond?
    - How to effectively use custodian farmers (may be their network) in management of agricultural biodiversity on-farm?
    - How custodian farmers increase sources of germplasm and knowledge?
6. Local institutions
    - How to identify and how to empower local institutions?
    - How to promote community biodiversity management (CBM) through local institutions?
    - What type of institutions would be suitable for promoting CBM approach at grassroots level?

The issues were further discussed and refined during the course of the workshop. The framework provided a basis for the brainstorming sessions that followed.

Important research related aspects to be taken into consideration when developing the concept note included:

- To emphasize on-farm aspect of on-farm diversity on farmers' fields and possible characterization
- To look at typical interventions – increased diversity that farmers have access to; simple approaches that have impact on the diversity and livelihood; simple research, powerful in testing the efficiency of tools
- To adopt practices that are widely applicable
- To identify clear indicators

It was agreed that the proposed project will test community-based interventions to increase the availability and accessibility of agrobiodiversity for the improvement of conservation and farmers' livelihood. The strategies that would be incorporated will include community-science based and participatory multi-stakeholder approaches.

The following project and the outlines were agreed by the members:

Project 4: Increasing availability and accessibility to the rich agrobiodiversity for conservation and improvement of livelihoods of farmers in the Asia Pacific region

Background information

- Status of agrobiodiversity conservation and use – Nepal, India, Cambodia, China, Malaysia, Philippines, Indonesia, Vietnam
- Status of the tools intervention currently being implemented – Nepal, India, Philippines, Vietnam, Indonesia, China
- Current experiences and problems in implementation of these tools - Nepal, India, Philippines, Vietnam, Indonesia, China
- State current scientific measurement of outputs and outcomes of intervention tools that are in place

Main objective

To test community-based interventions to increase the availability and accessibility of agrobiodiversity for the improvement of conservation and farmers' livelihood

Specific objectives

- To assess the status and patterns of biodiversity of target crops and livelihood of farmers in Asia-Pacific region
- To assess the change affected by the methods/tools/good practices on agrobiodiversity and livelihoods
- To enhance the capacity building of partners and communities for efficient implementation of the interventions

Methodologies

- Agreed criteria for site selection
- Participatory diagnostic studies
- Baseline study
- Developing common agreed indicators for testing and measurement of all interventions, outputs and outcomes
- Testing of interventions at project sites
- Analysis of data

Possible approaches

- Community-science based approach
- Participatory multi-stakeholder approach

Criteria for identifying partners

- Current institutions actively involved in agrobiodiversity work

- Current institutions (including NGOs, CSOs and farmers' organizations) actively involved in the development of the intervention tools of agrobiodiversity
- Community-based organizations
- Relevant national agricultural research institutions and their partners (use of outputs to influence policy makers)
- Institutions involved in rural social studies

Group 3. Interactions between agricultural and wild ecosystems, and ecosystem services to agriculture

Facilitator : *Riina Jalonen*

Members:

Dr. Norowi Hamid	Dr. Meine van Noordwijk
Mr. Nathaniel Don E.M.	Dr. Rita Manurong
Dr. Teodoro Solsoloy	Dr. Pham Duc Chien
Dr. Paul Quek	Mr. Choo Kwong Yan
Mr. Zhang En Lai	

The theme of ecosystem services (ES) is wide and provided many possible directions for developing project ideas. Before the workshop, the facilitator compiled information on the theme and ideas on research questions from research literature, relevant CGIAR Research Programmes, and European Union (EU) priorities on ecosystem services, to stimulate discussions among the group members already beforehand. Group members were also invited to share project ideas or existing concept notes for discussion and development during the workshop. At the beginning of the workshop, Dr. Meine van Noordwijk (ICRAF) set the scene for the group discussion in his keynote presentation, in which he encouraged the participants to think of land uses and ecosystem service provision through integration rather than segregation of uses.

A set of researchable questions were identified during the session on topic prioritization. These included the following:

- How are biological processes which support ES disrupted when land uses change in the landscape? What are the implications to livelihoods?
- How can co-evolution of species be conserved in farming systems and their landscape context? How do farmers adapt to changes through adapting inter/intra-specific composition or management practices?
- Gradients from local resource use to market-based delivery of goods and services: how does reliance on ES change and why?
- Is diversity a good risk reduction strategy? Providing evidence of the advantages and disadvantages of diversity (on-farm and in the landscape context)

- How to enhance maintenance of ecosystem services (ES) within watersheds by linking provision and use of hydrological services (upstream – downstream)?
- What incentives can promote maintenance or enhancement of ES and in which contexts?
- Documentation of survival foods for indigenous and local communities and how they are affected by land use transitions

Key issues concerning research and management of ecosystem services were also identified as follows:

- Land tenure, negotiation power of local people
- Scaling up evidence and strategies from farm to national levels
- Much research, little effect on policies – how to achieve change among policy makers?
- Climate change as an entry point
- Projects need to produce 'immediate' benefits to locals to justify participation, learning aspects for the scientific and policy communities, and have relevance to global ES benefits

As a general strategy for addressing the questions around ecosystem services, it was suggested to establish a network of landscapes which would allow replication across sites and identification of general principles in ES provision, while studying context specific questions. Establishing such network was initially discussed as a project idea of its own. The network would have provided a framework for the countries and different interest groups to study research questions which are relevant for them, while at the same time allowing opportunities for replication across sites, sharing of expertise and experiences.

It was recognized that different ecosystem services are provided in different ways and at different scales. For formulating detailed research strategies, it would, therefore, be necessary to first decide which ES to study. Several participants in the group showed interest towards studying regulating services on pests and diseases in landscapes and their livelihood consequences, and this topic was discussed as a potential research idea.

In the end, however, the participants realized that very different ES and issues are relevant for different people in different settings. Rather than choosing the studied ES *a priori* based on subjective interests, it was decided to propose a project for exploring which issues and problems local people actually are facing across landscapes in Asia and the Pacific, how the changes are affecting their livelihoods, and what kind of coping strategies could be identified and envisioned. This idea was then developed into a concept note. The idea of the landscape site network was finally merged in the concept note, while suggesting that the network could continue to exist and evolve to more permanent landscape sites after the initial project.

As a result of in-depth discussions, the following project and the outlines were developed:

Project 5 : Agrobiodiversity transitions and deficits: Understanding and managing changes in diversity and local thresholds to the sustainability of ecosystem services in Asian land use systems

Background and problem statement

- Natural habitats in the landscape provide regulating, supporting, provisioning and cultural services which support local livelihoods and healthy environment, and buffer against environmental and socioeconomic variation
    - ❖ The services, for example, include pest and disease control, habitats for pollinators, soil formation, erosion control, nutrient cycling, regulation of water flows, microclimate, crop wild relatives, wild food sources
- Trends in land use generally go towards concentrating and intensifying the production of the provisioning services
    - ❖ Less variation and diversity, but of more direct benefit to the people
    - ❖ Impacts on the provisioning of indirect benefits, stability, resilience
    - ❖ Key transition points in land use patterns which affect the provisioning of the services in a landscape context
    - ❖ Natural forested ecosystems to agroforestry/swidden agriculture
    - ❖ Agroforestry to intensive tree crops
    - ❖ Agroforestry to intensive annual crops

These reflect changes in plant community compositions which determine the provisioning of ecosystem services, and in the dependency on external inputs for compensation for the services

- ❖ Functional diversity (efficient use of physical resources)
- ❖ Structural diversity
- ❖ Vegetation biomass and its seasonality (capacity of regulation services)
- ❖ Inter and intraspecific diversity (stability, resilience, adaptive capacity)

- Provisioning of regulating and supporting services can be compensated with artificial irrigation, pesticides, fertilizers, etc. These require market integration and purchasing power.
- Often, however, integration to markets and monetary economy follow intensification of resource use and extraction with delay, resulting in the reduction of service provision while alternative sources for compensating them are not yet widely available.
- Climate change adds to the effects of land use transitions. It affects the productivity of farming systems, increases the dependency on regulating and supporting ecosystem services, while at the same time degrades the capacity of ecosystems to provide these services.
- If the dynamics of biodiversity and ecosystem service provision during land use transitions were better understood in local contexts, policies and strategies could be designed to better maintain or re-establish the services during the transitions (integration of the production of goods and ecosystem services in production systems, instead of segregation).

- This would reduce the vulnerability of ecosystems and local communities in the face of volatility of environmental or socioeconomic conditions, and support the continued provision of key ecosystem services and sustainable livelihoods. It would also contribute to reduced tradeoffs and conflicts between land uses and users.
- This project will analyze (i) the key environmental services and their dynamics during land use transition points in different local contexts, (ii) consequences of these dynamics and thresholds in service provision to the livelihood strategies of local communities, and (iii) identify and propose replicable elements for strategies and policies which can be used to manage impacts of land use transitions on the key environmental services.
- Description of the status of agrobiodiversity in the Asia-Pacific region: key issues, trends.
- The project is part of the strategy for operationalizing the Suwon Agrobiodiversity Framework of APAARI, endorsed by GFAR and the CGIAR Centers.
- Assessment and appraisal of ecosystem service provision supports the agenda of Inter-Governmental Platform on Biodiversity and Ecosystem Services (IPBES) (looks for countries to commit) – agriculture/agrobiodiversity not often considered.

Main objective

Local communities and policy makers understand and appreciate the impacts of land use transitions on the provision of those ecosystem services which are critical for local livelihood strategies, and have capacities and tools to manage these impacts for more sustainable livelihoods in changing landscapes.

Specific objectives

- Understand the patterns of change in the provision of key ecosystem services and their consequences to livelihoods at landscape transition points in different local contexts.
- Identify replicable elements for strategies and policies which can be used to manage impacts of land use transitions on the key environmental services (slowing down, avoiding unnecessary losses, adding diversity components to reverse the trends), and communicate these to policymakers and local communities.

Research methodology

- Landscape approach: cultivated, non-cultivated areas, linkages of the different land use types within a landscape are also in transition. What elements are needed in the landscape to sustain the provision of the services, and how does spatial arrangement in the landscape influence its effectiveness?
- Participatory rural appraisal to analyse landscape and livelihoods in the socioeconomic context (land tenure, power relations, traditional knowledge, cultural significances and uses of agrobiodiversity): focus group discussions, etc.
- Landscape analysis tools developed by ICRAF (http://www.worldagroforestry.org/sea/ projects/ tulsea/) and CIFOR (http://www.cifor.org/mla) and the CIFOR-ICRAF Biodiversity Platform (http://www.biodiversityplatform.cgiar.org/_ref/home/index.htm).

- Studies on species and genetic diversity, depending on the transition points.
- Establishment of a network of long-term landscape sites for comparative research on ecosystem service provision along land use transitions and across local contexts.
- Development of indicators for vulnerability assessment and monitoring of ecosystem service provision and livelihoods during transitions.
- Analysis of the existing policy framework and its enforcement/application.
- Policy and stakeholder dialogue to identify improved policy options and management strategies, fostering collaboration between policy makers and land user groups.

Intended beneficiaries

- Local communities in the study landscapes, especially those most dependent on the services agrobiodiversity supports.
- National and local governments, NARS, civil society in terms of better management of the tradeoffs between agrobiodiversity for long-term values and risk reduction, and the short-term gains of simplified systems.

The five concept notes are being developed and refined by the working groups formed during the workshop. Priority topics included germplasm utilization, crop wild relatives, enhancing the use of underutilized species, increased availability to agrobiodiversity and understanding and managing changes in diversity – all leading to the greater call of addressing issues related to gender, poverty, minorities, sustainable agriculture and climate change. These concept notes will be strategically targeted toward specific funding opportunities.

Conclusion

As an immediate follow-up to the workshop, it was decided to develop on priority the concept notes and full proposals for three projects: (i) Acquisition and accessing of crop wild relatives and accessing novel alleles for enhanced use, (ii) Enhancing use of underutilized species for improved livelihoods and diversified diets, and (iii) Increasing availability and accessibility to the rich agrobiodiversity for conservation and improvement of livelihoods of farmers in the Asia-Pacific region. The FAO has agreed to provide funding support for hiring the consultants for developing these concept notes and project proposals and these are currently in different stages of development. A series of extensive literature review on experiences related to interventions proposed in the concept notes will be conducted. Further, the methodologies and activities to be carried out and innovative approaches to be adopted in addressing issues related to gender, poverty, minorities, sustainable agriculture and climate change will be further described before finalization and submission of concept notes and project proposals to the relevant funding agencies.

Annex. 1

Workshop Programme

4 November 2011 (Friday, MTBIC MARDI, Serdang)

Time	Programme	
08.00 - 08.15	Registration	
08:15 - 08:45	**Opening session** Welcome Address : Dr. Bhag Mal Address by Chief Guest : Dr. Abd. Shukor Abd. Rahman Vote of Thanks : Dr. Leocadio Sebastian	
	Plenary Sessions *Chairs* : Dr. Abd. Shukor Abd. Rahman Dr. Bhag Mal	
08.45 - 09.30	**Plenary 1.** Agrobiodiversity agenda in the CGIAR research programmes (CRPs)	Dr. Kwesi Atta Krah
09.30 - 10.15	**Plenary 2.** Applying strategies and technologies to enhance *in situ* and *ex situ* conservation through use with the goal of enhancing livelihood and reducing poverty	Dr. P.N. Mathur
10.15 - 10.45	**Group Photo and Tea/Coffee Break**	
10.45 - 11.30	**Plenary 3.** Assessment of the agrobiodiversity richness and status relative to economic, social and cultural factors	Dr. Mauricio Bellon
11.30 - 12.15	**Plenary 4.** Interactions between agricultural and wild ecosystems, and ecosystem services for agriculture	Dr. Meine van Noordwijk
12.15 - 12.30	General Discussion	
12.30 - 14.00	**Lunch and Prayer Time**	
14.00 - 14.20	**Plenary 5.** Collective action of the Development Opportunity Crops Initiative toward the diversification of agriculture	Dr. Michael Hermann
14.20 - 14.40	**Plenary 6.** Funding opportunities - FAO	Dr. Kakoli Ghosh
14.40 - 15.00	**Plenary 7.** Collaborative opportunities under the Asian Food and Agriculture Cooperation Initiative (AFACI)	Dr. Kim Haeng-hoon
15.00 - 15.30	**Tea/Coffee Break**	
15.30 - 16.30	**Group Discussion 1**. Topic Prioritization	Group Facilitators
16.30 - 18.00	Plenary Discussion on group outputs 1	Dr. Leocadio Sebastian
18.00 - 19.30	Tour of Putrajaya	
19.30 - 21.00	Social dinner hosted by Bioversity International	

5 November 2011 (Saturday, Cititel Midvalley, Kuala Lumpur)

Time	Programme	
08.30 - 10.15	**Group Discussion 2.** Objective settings	Group Facilitators
10.15 - 10.30	**Tea/Coffee Break**	
10.30 - 11.15	Plenary Discussion on group outputs 2	Dr. Leocadio Sebastian
11.15 - 12.30	**Group Discussion 3.** Discussion on methodology, possible approaches, expected project outputs	Group Facilitators
12.30 - 13.30	**Lunch**	
13.30 - 14.30	Plenary Discussion on group outputs 3	Dr. Leocadio Sebastian
14.30 - 15.30	**Group discussion 4.** Refining the group outputs, identify prospective partners, assign task for future follow-ups	Group Facilitators
15.30 - 16.00	**Tea/Coffee Break**	
16.00 - 17.00	Plenary Discussion on group outputs 4	Dr. Leocadio Sebastian
17.30 - 17.45	**Official Closing Ceremony**	
	Remarks : Dr. Kwesi Atta Krah, Bioversity International : Dr. Kakoli Ghosh, FAO Concluding Remarks & Giving Away the Prizes : Dr. Bhag Mal, APAARI	
19.00 - 21.00	Social dinner hosted by APAARI	

6 November 2011 (Sunday, Cititel Midvalley, Kuala Lumpur)

Time	Programme	
09.15 - 10.15	Finalization of concept notes	Selected experts
10.15 - 10.30	**Tea/Coffee Break**	
10.30 - 12.30	Finalization of concept notes	Selected experts
12.30	**Lunch/End of Session**	

Annex. 2

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Annex. 3

Discussion Guide - Group 1

Background

Agrobiodiversity is the foundation of sustainable agriculture development. Plant Genetic Resources for Food and Agriculture (PGRFA), that constitute a major part of current agrobiodiversity, are an essential resource to meet our food security. In order to maximize the utilization of plant genetic resources for enhancing agricultural production and reducing poverty, Suwon Declaration identified the following major focus areas for research and development:

Strategies and technologies to enhance *in situ* and *ex situ* conservation through use:

The aim must be to generate and synthesize coherent messages with appropriate information and knowledge, evidence and tools which can contribute to the understanding of genetic diversity and its effective use, especially

a. The incorporation of information/knowledge and new technologies (genomics) into integrated approaches that can promote the understanding of the diversity distribution and identification of useful traits for adaptation to climate change, and other abiotic and biotic stresses.

b. Research should explore the potential of consumer preferences, certification strategies, geographic indication, community and farmers' rights or payment systems for ecosystem services to secure agrobiodiversity for the future and exploit its direct values and uses. A market oriented approach is very important in enhancing the economic status of farmers involved in conservation and use of genetic resources.

c. Efforts need to be made to empower traditional custodians of biodiversity in the region for *in situ* conservation on-farm to enhance conservation of landraces and wild relatives of cultivated crops and livestock, both *in situ* and on-farm together with its associated knowledge.

d. Apply proven modalities for community based biodiversity conservation with partners especially the civil societies, such as supporting communities to sustainably use local genetic diversity to reduce vulnerability and crop loss and to sustain the resilience and ecosystem services of their production systems.

e. Promote cost effective complementary *ex situ* and *in situ* strategies for conservation of genetic resources.

In this workshop, the discussion will be centred around the key areas that can be finalized and developed into concept notes. To do so, additional background on conservation (*ex situ* and *in situ*) through use is provided below:

Workshop on the Suwon Agrobiodiversity Framework – Group Discussions

Theme : Applying strategies and technologies to enhance *in situ* and *ex situ* conservation through use with the goal of enhancing livelihood and reducing poverty

It is now recognized that by 2050, the world's population will be a little over 9.1 billion and much of this increase is going to be in developing countries and in particular in Asia, the Pacific and Oceania (APO) region. It is also foreseen that urbanization will continue at an accelerated pace, thus reducing the area under agriculture for livelihood means. This would translate into the fact that annual cereal production will need to rise to about 3 billion tonnes from 2.1 billion today and annual meat production will need to rise by over 200 million tonnes to reach 470 million tonnes. There is great debate as to how this increase is going to be achieved with continuing reduction in farming communities, arable land and changing climate (especially precipitation and temperature- two most important factors that govern agricultural production.

It is argued that part of the required increase in food production can be achieved if the necessary investment is undertaken in utilizing plant genetic resources that are extant in *ex situ* genebanks and *in situ* (landraces that are in farmers' fields and crop wild relatives in the wild), along with policies conducive to agricultural production. This should be complemented by policies to enhance access by fighting poverty, especially in rural areas, as well as effective safety net programmes.

Current status of conservation

Before going to the question of how best we can use the available plant genetic resources for meeting the increasing demands, there is a need to look briefly at conservation measures that are underway in various countries and international agencies. Also the constraints for using these resources, need to be examined.

***Ex situ* conservation**

Since the publication of the first SoW report, more than 1.4 million accessions have been added to *ex situ* collections, the large majority of which are in the form of seeds. Fewer countries now account for a larger percentage of the total world *ex situ* germplasm holdings than was the case in 1996. While many major crops are well or even overduplicated, many important collections are inadequately so and hence potentially are at risk. For several staple crops, such as wheat and rice, a large part of the genetic diversity is currently represented in collections. However, for many others, considerable gaps remain. Interest in collecting CWR, landraces and neglected and underutilized species, is growing as land-use systems change and environmental concerns increase the likelihood of their erosion. Many countries still lack adequate human capacity, facilities, funds or management systems to meet their *ex situ* conservation needs and obligations, and as a result, a number of collections are at risk. While significant advances have been made in regeneration in both national and international collections, further work remains to be done (FAO, 2010).

***In situ* conservation**

Since the first SoW report was published, a large number of surveys and inventories have been carried out in many different countries, both in natural and agricultural ecosystems.

Awareness of the importance and value of CWR and of the need to conserve them *in situ* has increased. A global strategy for CWR conservation and use has been drafted, protocols for the *in situ* conservation of CWR are now available, and a new Specialist Group on CWR has been established within the International Union for Conservation of Nature/Species Survival Commission (SSC-IUCN). The number and coverage of protected areas has expanded by approximately 30 per cent over the past decade and this has indirectly led to a greater protection of CWR. However, relatively little progress has been achieved in conserving wild PGRFA outside protected areas or in developing sustainable management techniques for plants harvested from the wild.

Significant progress has been made in the development of tools and techniques to assess and monitor PGRFA within agricultural production systems. Countries now report a greater understanding of the amount and distribution of genetic diversity in the field, as well as the value of local seed systems in maintaining such diversity. More attention is now being paid in several countries to increasing genetic diversity within production systems as a way to reduce risk, particularly in the light of changes in climate, pests and diseases. The number of on-farm management projects carried out with the participation of local stakeholders has increased somewhat and new legal mechanisms have been put in place in several countries to enable farmers to market genetically diverse varieties. There is still a need for more effective policies, legislation and regulations governing the *in situ* and on-farm management of PGRFA, both inside and outside protected areas, and closer collaboration and coordination are needed between the agriculture and environment sectors. Many aspects of *in situ* management still require further research and strengthened research capacity is required in such areas as the taxonomy of CWR and the use of molecular tools to conduct inventories and surveys (FAO 2010). There is still an ongoing need to improve the coverage of diversity in *ex situ* collections, including CWR and farmers' varieties, coupled with better characterization, evaluation and documentation of the collections.

Complementary conservation

The idea of complementary conservation is not new and has been around for a couple of decades, mostly using different *ex situ* methods. More recently, there is also the discussion about making *in situ* as part of complementary conservation strategy (CCS). Although there are several papers indicating that CCS is feasible and advantageous (Drew and Ashmore, 2003; Engelmann and Engels, 2002; Ramanatha Rao and B.M.C. Reddy, 2010; Reed *et al*. 2004), not many real-life examples could be found. This is really a great opportunity for rationalizing collections (many collections badly need it) and to make conservation increasingly cost effective. In addition, this approach widens the net of conservation efforts and helps not only conserving these most important resources for agricultural for future use but makes them more amenable for utilization.

Utilization of plant genetic resources

The sustainable use of PGRFA primarily through plant breeding and associated seed systems remains essential for food security, viable agricultural enterprise and for adaptation to climate change. By aggregating data globally, it appears that plant breeding capacity has not changed significantly during the last 15 years. A modest increase in the number of plant breeders has been reported in some countries and a decline in others. In many countries public sector

plant breeding has continued to contract, with the private sector increasingly taking over. Agriculture in many developing countries that reduced their support to public sector crop development, leaving instead, the sustainable use of PGRFA to the private sector, is more vulnerable than in the past as private sector breeding and seed enterprise is restricted largely to a few crops for which farmers buy fresh seed each season. Considerably more attention and capacity building is urgently needed to strengthen plant breeding capacity and the associated seed systems in most developing countries, where most of the important crops are not, and will not be, the focus of private enterprise. The number of accessions characterized and evaluated has increased in all regions but not in all individual countries. More countries now use molecular markers to characterize their germplasm and undertake genetic enhancement and base-broadening to introduce new traits from non-adapted populations and wild relatives. Several new important international initiatives have been established to promote the increased use of PGRFA. The Global Partnership Initiative for Plant Breeding Capacity Building (GIPB), for instance, aims to enhance the sustainable use of PGRFA in developing countries through helping to build capacity in plant breeding and seed systems. The Global Crop Diversity Trust (GCDT), and the new Generation and Harvest Plus Challenge Programmes of the CGIAR, all support the increased characterization, evaluation and improvement of germplasm. Genomics, proteomics, bioinformatics and climate change were all absent from the first SoW report but are important now, and greater prominence is also given to sustainable agriculture, biofuel crops and human health. Although progress in research and development of neglected and underutilized species, as recommended in the first SoW report, is difficult to gauge, it is clear that further efforts are needed (FAO, 2010).

In a world of changing climates, expanding population, new pests and diseases, ever increasing resource scarcity and financial and social turmoil, the sustainable use of PGRFA has never been so important as now or offered greater opportunities. The development of new varieties of crops critically depends on breeders and farmers having access to the genetic diversity in order to develop varieties with higher and more reliable yields, resistant to pests and diseases, tolerant to abiotic stresses, making more efficient use of resources, and producing new and better quality products and by-products. Of course, PGRFA also have many other uses including direct introduction for production on-farm, as well as education and scientific research on topics ranging from crop origins to gene expression. They are also used for land restoration and traditional and local varieties are often very important socially and culturally. While there is an indication from the country reports that the value of PGRFA for such uses is increasing, this chapter will concentrate mainly on what remains their primary use: breeding new crop varieties and their dissemination to farmers. The chapter provides an overview of the current state of PGRFA use, with special attention paid to the situation in developing countries that, in many cases, still lack the human and financial resources needed to make full use of PGRFA (FAO, 2010).

The contribution of PGRFA to food security and sustainable agricultural development and poverty reduction

Sustainable development has grown from being a movement focusing mainly on environmental concerns, to a widely recognized framework that aims to balance economic, social, environmental and inter-generational concerns in decision-making and action at all levels. There have been growing efforts to strengthen the relationship between agriculture and the provision of ecosystem services. Schemes that promote payment for environmental services (PES), such as the *in situ*

or on-farm conservation of PGRFA, are being set up in an attempt to encourage and reward farmers and rural communities for their stewardship of the environment. However, the fair and effective implementation of such schemes remains a major challenge. Concerns about the potential impact of climate change have grown substantially over the past decade. Agriculture is both a source and a sink for atmospheric carbon. PGRFA are recognized as being critically important for the development of farming systems that capture more carbon and emit fewer greenhouse gasses, and for underpinning the breeding of new varieties that will be needed for agriculture to adapt to the anticipated future environmental conditions. Given the time needed to breed a new crop variety, it is essential that additional plant breeding capacity be built now. There is a need for more accurate and reliable measures, standards, indicators and baseline data for sustainability and food security that will enable better monitoring and assessment of the progress made in these areas. Standards and indicators that will enable the monitoring of the specific role played by PGRFA are needed particularly. In spite of the enormous contribution by PGRFA to global food security and sustainable agriculture, their role is not widely recognized or understood. Greater efforts are needed to estimate the full value of PGRFA, to assess the impact of its use and to bring this information to the attention of policy-makers and the general public so as to help generate the resources needed to strengthen programmes for its conservation and use.

Climate change and PGRFA

While the effects of climate change are only now beginning to be felt, there is a growing consensus that unless drastic measures are taken its future impact could be enormous. Prediction models of the IPCC19 as well as other reports indicate that there will be severe effects on agricultural productivity in many parts of the world. There is evidence that climate change is already affecting biodiversity and will continue to do so. The Millennium Ecosystem Assessment ranks climate change among the main direct drivers affecting ecosystems. Consequences of climate change on the species component of biodiversity include:

- Changes in distribution
- Increased extinction rates
- Changes in reproduction timings
- Changes in length of growing seasons for plants
- Changes in plant community composition
- Changes in ecosystems

These changes will result significant changes in farming practices and genetic resources that we use now. The available evidence is still being debated; however, most researchers working in the area of climate change agree that there will be drastic changes in available water supply in different regions of the globe, which will have major effect of agricultural systems as well as on total productivity (Ramanatha Rao, 2009). Current information available indicates that subtropical regions received less precipitation and were subjected to more frequent droughts, while the northern hemisphere received higher rainfall in recent past. Nevertheless, research to date suggests this trend is less predictable but at the same time, the degree of variation will be more pronounced (IPCC, 2001;2002; CBD 2007). All of these will have serious consequences on agriculture, maintenance of agricultural biodiversity and crop improvement.

The news is not all bad, however; some regions, especially those further away from the equator, are expected to have longer growing seasons and will become more productive, as long as high yielding varieties that are adapted to the new environmental conditions are available. Unfortunately, it is expected that regions such as South Asia and Southern Africa are likely to be most affected by climate change; areas of the world that are home to the largest number of poor people and that are least able to cope. In many regions, adapting agriculture to the new conditions will require a shift to more drought-tolerant or heat-tolerant varieties or even to other crops. Changes in pest and disease patterns are likely to take place and indeed may be already happening, resulting in the need for new resistant or tolerant varieties. Less predictable weather patterns may also require the development of new varieties that are adapted to a wider range of more extreme conditions.

New varieties will also be needed for agriculture to be able to play a greater role in mitigating climate change. For example, varieties with greater biomass, e.g. that have deeper root system, coupled with appropriate agronomic practices, can result in the capture of more carbon in the soil. Feed and forage varieties that result in less methane being emitted by ruminants can be bred as well as varieties that are able to use nitrogen more efficiently and need less fertilizer and hence less total energy, but also result in reduced emissions of the potent greenhouse gas nitrous oxide. Although bioenergy crops were mentioned in only relatively few country reports, there have been significant moves to increase the production of biofuels in many countries in response to growing concerns about climate change and in the face of fossil fuel scarcity (FAO, 2010). For the time being, it is suggested that the focus on biofuels must only be on how to make this possible from organic waste and not from agricultural crops; as we all understand that the food requirements have higher priority over fuel needs.

Overall, the difficulties of mitigating against and adapting to climate change are likely to make it considerably more difficult to meet the increased demand for food in the future. The challenge will be exacerbated further by growing competition for land for other uses, such as urban development or for growing new crops. In order to meet such challenges, it is essential that greater attention be paid to conserving genetic diversity and in particular, to targeting the collection and conservation of landraces and CWR that have traits that are likely to become more important in the future. Coupled with this, it is essential that plant breeding efforts be stepped up around the world, especially in those developing countries that are likely to be hardest hit by climate change. This will require greatly enhanced attention to capacity building in traditional as well as modern crop improvement techniques (FAO, 2010).

What can be done to improve the utilization of extant plant genetic resources?

There is an urgent need to increase plant breeding capacity worldwide in order to be able to adapt agriculture to meet the rapidly expanding demand for more and different food, as well as non-food products, under substantially different climatic conditions from the present. The training of more breeders, technicians and field workers and the provision of better facilities and adequate funds are all essential. In order to meet these goals, these is a need to focus on:

- Greater awareness of the value of PGRFA and the importance of crop improvement, in meeting future global challenges among policymakers, donors and the general public;
- Adopt appropriate and effective strategies, policies, legal frameworks and regulations that promote the use of PGRFA, including appropriate seed legislation;

- Take advantage of opportunities that exist for strengthening cooperation among those involved in the conservation and sustainable use of PGRFA, at all stages of the seed and food chain. Stronger links are needed, especially between plant breeders and those involved in the seed system, as well as between the public and private sectors;
- Greater efforts in order to mainstream new biotechnological and other tools within plant breeding programmes;
- Greater understanding of biological, institutional and community gaps for developing and promoting complementary conservation strategies, especially for large gene pools, so that conservation can become more cost effective.

To enhance the conservation and use of agrobiodiversity, either from *ex situ* or *in situ*, to build a sustainable system for increased food security, improved livelihoods and long-term availability of genetic resources in the context of changing climate. In order to address the issues mentioned above, any proposal that is developed should aim to:

- ❖ Better understand the role of climate change in specific regions of APO and conceptualize agricultural research needs according to the predicted changes;
- ❖ Identify new and useful genetic variation, especially for biotic and abiotic stresses, from all available plant resources to accelerate the genetic improvement of modern crop varieties;
- ❖ Understand the role of local seed systems in enabling adaptation under changing production constraints;
- ❖ Establishing guidelines for community managed crop genetic resources including community seed banks and its sustainability for adapted varieties;
- ❖ Understand the role of national and local seed systems in enabling adaptation under changing production constraints;
- ❖ Diversification of the farming systems in the context of climate change by introducing new crops and varieties;
- ❖ Understand social and cultural barriers to adoption of target crops and their adapted landraces and varieties and explore effective means of introducing new adapted landraces and varieties taking into account these barriers;
- ❖ Explore means of strengthening the link between genebanks, researchers, extension workers and local farmers in the context of adaptation to climate risks;
- ❖ Explore and use new methods of data mining and biotechnological tools that help to hasten the testing and making available new cultivars and crops to farmers;
- ❖ Conceptualize and implement comprehensive pre-breeding programmes for several major and minor but potential crops that aim to guarantee the sustainability of crop production against the background of a growing global population and changing environment;
- ❖ Develop complementary conservation strategies for major crop genepools to make conservation more cost effective.

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Annex. 4

Discussion Guide - Group 2

Issues/research questions	Data needs/indicators	Methods of data collection	Key references
1. Assessing richness, evenness and divergence of agrobiodiversity in a given household, community, landscape level (unit of measurement) Should we aim for high evenness with moderate richness for addressing negative impact of uniformity? Should we aim for high community divergence of PGRFA for community resilience-against climatic adversity, market and other forces?	- No of crops/household (HH) - No of landraces/variety/HH - Area (plants) under crop/HH - Area under landrace/variety/ HH or No of trees/home garden/HH - No of landraces/varieties in a given community - Unique/rare landraces - Knowledge about specific traits in a given landrace/ variety - Trends (no of crops/varieties and no of HHs growing them over time) - Set of traits or named landrace	- Biodiversity fair - Community biodiversity register - Four cell analysis - Household survey - Group discussion - Key informant interviews (custodian farmers) - In-depth interviews with knowledge/ genetic resource holders (custodian farmers/old farmers by gender) - Time line analysis	Jarvis *et al*, 2008
2. Socioeconomic factors 2.1 What are the socioeconomic factors that influence management of agrobiodiversity on-farm? 2.2 Which socioeconomic factors play key positive role in management of agrobiodiversity on-farm?	- Economic status of individual/HH - Income of individual/HH - Education status - Social status in society - Livelihood diversification - Labour availability - Land holding size and quality - Fragmentation of land/land parcels - Cultivable land spread in different agro-ecosystems - Integrated farming - Access to irrigation, credit, market, road, communication, , seed, technical knowledge - Exposure to external interventions - Membership in groups/ networks	- Secondary information - PRA tools (well being ranking, social and resource mapping, Venn diagram, seasonal calendar, focus group discussion) - Household survey - Direct observation	Friis-Hansen, 2000 Cleveland and Soleri, 2002 Brush, 1995

Issues/research questions	Data needs/indicators	Methods of data collection	Key references
3. Cultural/religious factors 3.1 How cultural diversity is associated with agrobiodiversity? 3.2 What are cultural driving forces that support management of local diversity? 3.3 How landraces with socio-cultural and religious values be marketed for promoting agrobiodiversity conservation on-farm?	- Documenting food culture - Cultural practices and use of diverse crops/varieties by different communities over seasons - Religious functions performed and use of diverse crops/varieties over seasons - Cultural/religious practices that favour (otherwise) maintenance of agrobiodiversity on-farm - Finding the right custodians for perpetuate positive cultural diversity that promotes agrobiodiversity on-farm - Problems and constraints to promoting diversity	- Traditional food fair - In-depth interview between the generation (women/men) - Participant observation - Field diary - Focus group discussion - Key informant interviews - Oral histories - Document analysis	Simpson, 1994 Kieft, 2001 Toledo, 2001
4. Market forces 4.1 Can market forces play some role in conservation of agricultural biodiversity on-farm? 4.2 How to assure markets work for conservation of landraces with unique traits? 4.3 What would be the incentive mechanism for market to play positive role in conservation? 4.4 What are strategies that support co-existence of commercialization and diversity-oriented management?	- Different actors and their role in value chain - Constraints and opportunities in making market work for conservation of agrobiodiversity - Market response to pilot value added products/landrace	- Rapid market appraisal - Problem tree analysis or force field analysis - Value chain analysis - Stakeholders workshop - In-depth interviews with actors in value chain - Observation - Record analysis	Smale *et al*, 2004

Issues/research questions	Data needs/indicators	Methods of data collection	Key references
5. Network and custodian farmers 5.1 How custodian farmers, who maintain rich diversity (crops and knowledge) on-farm, are distributed in different communities? 5.2 What are the characteristics of custodian farmers, who maintain rich diversity on-farm? 5.3 What motivates custodian farmers to maintain and exchange rich diversity between farms and beyond? 5.4 How to effectively use custodian farmers (maybe their network) in management of agricultural biodiversity on-farm? 5.5 How custodian farmers increase sources of germplasm and knowledge?	- Definition of custodian farmers (how local people define them) - Distribution of custodian farmers in a given community - Different custodian farmers for different crops or same - Salient features of custodian farmers - Documenting motivating factors for maintaining and sharing genetic resources/ knowledge - Interaction level between custodian farmers and common community people - Flow of genetic materials and information within and between communities	- Mapping of custodian farmers for different crops/ varieties - Semi-structured interview - Focus group discussions - In-depth interviews - Social mapping of interaction and flow of genetic materials	
6. Local institutions 6.1 How to identify and how to empower local institutions? 6.2 How to promote community biodiversity management (CBM) through local institutions? 6.3 What type of institutions would be suitable for promoting CBM approach at grassroots level?	- Number and types of local institutions in a given area - Scope and geographic coverage of these local institutions - Scope for harmonizing conservation work through existing local institutions - Assessing the status of technical, managerial, institutional, financial worth of local institutions - Legacy of local institutions (formal, informal)	- Scoping study of current local level institutions - Institutional mapping exercise - Venn diagram - Stakeholders workshop - SWOT analysis	Carloni and Crowley, 2005

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Annex. 5

Discussion Guide - Group 3

Theme : Interactions of agricultural and wild ecosystems, and ecosystem services to agriculture

Theme description in the Suwon Agrobiodiversity Framework

5. Interdisciplinary studies on the invaluable ecosystem services for agriculture that agricultural landscapes, forests and other mainly wild ecosystems provide (following CBD-COP 5 Ecosystems Approach):

Degradation of wild ecosystems in the landscape has important implications to agriculture and food production. compensating the lost ecosystem services with artificial irrigation systems, growth media, fertilizers or pesticides is potentially not only costly but probably not even viable in many resource-poor areas. There is a need to better understand the relationships between society and nature in the socio-ecological landscape (as those envisioned in the CBD-COP 10 Satoyama Initiative). It is, therefore, worth looking into the following aspects:

- The role of wild ecosystems in providing services for forest and other agricultural systems, the processes and interactions which maintain these services, and the threats that they are facing.
- Planning rehabilitation and maintenance of diverse landscape mosaics of agricultural lands and viable wild ecosystems including policies that support their creation and maintenance.
- Adaptation of wild ecosystems to changing environment as a prerequisite for the continued provision of the services as their demand increases.

Background

Objective of the research theme is to better understand the nature and extent of ecosystem services which predominantly wild ecosystems and biodiversity provide to agriculture and food production, factors affecting the provision of these services, and opportunities for their sustainable management. Relationship between agriculture and wild ecosystems is often considered unidirectional in that agriculture is seen negatively affecting wild ecosystems, while the dependency of agriculture on the services that these ecosystems provide is overlooked. Discussions will focus on locally relevant ecosystem services which are produced and whose benefits are realized in a landscape scale (thus excluding climatic effects of carbon sequestration). Relevant ecosystem services include pest management, pollination, genetic resources of crop wild relatives, soil formation, erosion regulation, nitrogen fixation and water cycles, occurring in local mosaics of wild and managed ecosystems.

As ecosystem services are interlinked, they should be studied together as far as possible, and in co-evolved rather than artificial communities (Swift *et al*. 2004). The scale – plot, farm, or landscape – is very important. Pest management is one of the few ecosystem services that is clearly realized and manageable already on a plot and farm scales (Zhang *et al*. 2007). In general,

ecosystem services on a plot scale can be rather easily substituted with e.g. artificial irrigation, pesticides or fertilizers, while the farmer may still enjoy of ecosystem services from neighbouring fields and forests as free-rider. Substitution becomes increasingly difficult and expensive on a landscape scale when the effects of ecosystem degradation and losses of services accumulate, as a consequence of plot and farm level decisions and processes. However, ecosystem services may seldom be maintained on a plot level unless they provide clear utilitarian benefits, and their maintenance in the landscape therefore normally requires specific policies and incentives (Swift *et al*. 2004).

Guiding questions for defining the focus for studies:

- What are the key problems related to understanding, managing, or benefitting from ecosystem services to agriculture in tropical Asia? What outcomes and impacts should be aimed for to improve agricultural sustainability and livelihoods?
- What kind of systems need to be studied or compared to improve understanding on ecosystem services? Why are they particularly interesting?
- What ecosystem services to focus on (and how many together)? Why are they particularly relevant?
- In what scale(s) should the services be studied and why?
- What socioeconomic questions would need to be addressed to strengthen biological research and identify feasible solutions on the studied systems, services or scales? Why are they important?

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