

SUSTAINING AGRICULTURAL BIODIVERSITY AND AGRO-ECOSYSTEM FUNCTIONS

Opportunities, incentives and approaches
for the conservation and sustainable use
of agricultural biodiversity
in agro-ecosystems and production systems

**International Technical Workshop organized jointly by
the Food and Agriculture Organization of the United Nations
and the Secretariat of the Convention on Biological Diversity,
with the support of the Government of the Netherlands**

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Executive Summary

Background

Agricultural biodiversity is essential for global food production, livelihood security and sustainable agricultural development. It is a major theme for implementation of the Convention on Biological Diversity (CBD). In this context, the CBD Secretariat together with FAO, the lead partner for the implementation of agricultural biodiversity activities, and with the support of the Government of the Netherlands, organized an international workshop on agricultural biodiversity from 2 to 4 December 1998 in Rome, Italy. This workshop is a follow-up to the first joint CBD – FAO technical workshop on agricultural biodiversity “Farming Systems Approaches for the Sustainable Use and Conservation of Agricultural Biodiversity and Agro-Ecosystems” (June 1997, Rome).

Workshop purpose and process

Over 60 participants attended from 20 countries representing all regions and 15 international and regional organizations. A dynamic discussion and review process, facilitated through small working groups and plenary sessions, led to the identification of key issues and related opportunities and proposed actions, mechanisms and linkages.

Focusing on agro-ecosystems and production systems levels, the workshop helped to identify the main elements required in order to provide enabling environments and technical, policy, institutional and legal incentives, from global to local levels, for the conservation and sustainable use of agricultural biodiversity. It was also a contribution to the assessment of ongoing activities and instruments being conducted by the CBD Secretariat and FAO, in accordance with COP decisions III/11 and IV/6. The workshop was designed to:

- *stimulate work at country level and within institutions;*
- *provide expert advice to FAO and the CBD on the assessment of ongoing activities and existing instruments;*
- *assist FAO and the CBD to identify complementary and synergistic activities;*
- *contribute to the FAO-Netherlands Conference on the Multifunctional Character of Agriculture and Land.*

Conclusions and recommendations

The workshop concluded that four sets of actions for the conservation and sustainable use of all agricultural biodiversity, especially at agro-ecosystem levels, should be prioritized. These are summarized under the headings: Information, assessment and indicators; Research and development; Awareness raising and capacity building; and Development of policies and instruments.

The workshop prioritized the following actions related to information, assessment and indicators:

- *to identify, develop and document indicators for assessment and monitoring as well*

- as understand the causes of and changes in agricultural biodiversity;*
- *to focus specifically on indicators for assessing changes at agro-ecosystem levels and on the economic forces that influence these changes;*
 - *to link indicators and assessment with particular dimensions of agricultural biodiversity, such as sustainable production, biological or life support and ecological and social services.*

Actions prioritized for research and development included:

- *emphasizing greater coordination and information sharing between research and development programmes and better formal and informal sector linkages;*
- *strengthening national agricultural research systems on agricultural biodiversity related issues;*
- *furthering farmer-driven participatory research and technology development processes, for example through farmer field schools;*
- *emphasizing three main issues: threats and positive incentives for agricultural biodiversity; ecosystem approaches and ecosystem functions; and specific research areas such as soil biota, pollinators and predators;*
- *developing communication methods and facilitating the exchange of information on relevant scientific research and practical information between different actors and stakeholders, especially South-South.*

Concerning awareness raising and capacity building, the workshop prioritized actions for:

- *capacity building to improve awareness, knowledge and information on agricultural biodiversity;*
- *capacity building to disseminate sustainable methods for agricultural biodiversity conservation;*
- *capacity building for decision-making and planning and policy-making on agricultural biodiversity.*

In relation to the development of policies and instruments, the workshop prioritized actions for:

- *integrating agricultural biodiversity in national biodiversity programmes and action plans as well as in national environmental action plans and agricultural strategies and plans;*
- *developing coordination and policy coherence at national, regional and international levels between relevant organizations, ministries and sectoral bodies at all levels;*
- *mitigating the influences of (and reforming where possible) the market, market forces and the existing economic framework which have major impacts on agricultural biodiversity;*
- *introducing incentive measures as important instruments to counter the above, including fees, charges, environmental taxes, certification and eco-labelling, as well as removing perverse incentives;*
- *developing and implementing a Code of Conduct on Agricultural Biodiversity, drawing together all existing agreements.*

In the light of these priorities, and bearing in mind the opportunities, incentives and

approaches discussed in the workshop, the participants made the following recommendations.

- Widening the understanding of the agricultural biodiversity by promoting a concept whereby **agricultural biodiversity encompasses the variety and variability of animals, plants and micro-organisms which are necessary to sustain key functions of the agro-ecosystem, its structure and processes for, and in support of, food production and food security.** Three dimensions of agricultural biodiversity could be useful for increasing understanding and as a structure for future programmes and plans:
 - i. **Sustainable production** of food and other agricultural products emphasizing both strengthening sustainability in production systems at all levels of intensity and improving the conservation, sustainable use and enhancement of the diversity of all genetic resources for food and agriculture, especially plant and animal genetic resources, in all types of production systems.
 - ii. **Biological or life support** to production emphasizing conservation, sustainable use and enhancement of the biological resources that support sustainable production systems, particularly soil biota, pollinators and predators.
 - iii. **Ecological and social services** provided by agro-ecosystems such as landscape and wildlife protection, soil protection and health (fertility, structure and function), water cycle and water quality, air quality, CO₂ sequestration, etc.
- Encouraging the maintenance, sustainable use and enhancement of all types and levels of agricultural biodiversity in all types of production systems from diverse to specialized, small- to large-scale and intensive to extensive systems. The workshop recognized that the interdependence among the plants and animals that are harvested with the agricultural biodiversity that provides biological or life support systems and ecological and social services is as relevant and essential to production in intensive specialized agricultural systems as it is in more diverse production systems.
- Improving integration and coordination of activities and processes for sustaining agricultural biodiversity, productivity and agro-ecosystem functions is urgently required as is the inclusion of action plans for the conservation and sustainable use of agricultural biodiversity in national biodiversity, environmental and agricultural policies, strategies, plans and programmes as well as in those of key institutions. The workshop also recommended that all organizations in the field of sustainable development need to work further to integrate and mainstream agricultural biodiversity in their policies, programmes and activities.

Contents

Cover letter	iii
Acknowledgements	v
Executive Summary	vii
Acronyms	xiii
1 INTRODUCTION	1
1.1 Background	1
1.2 Purpose of workshop	1
1.3 Workshop process	2
1.4 Structure of this report	3
2 WORKSHOP CONTEXT, TERMS AND CONCEPTS	4
2.1 Context	4
2.2 Terms and concepts	6
3 WORKSHOP RESULTS	8
3.1 Information, assessment and indicators	8
3.1.1 Exchange of and access to information	8
3.1.2 Assessment and indicators	9
3.2 Research and development	11
3.3 Awareness raising and capacity building	14
3.4 Development of policies and instruments	18
3.4.1 National, regional and international policy and regulatory frameworks	18
3.4.2 Coordination	19
3.4.3 Negative market influences	19
3.4.4 Incentive measures	20
3.4.5 The precautionary approach	21
3.4.6 Codes of conduct and practice	22

4	CONCLUSIONS AND RECOMMENDATIONS	23
4.1	Priority issues and action	23
4.1.1	Information, assessment and indicators	23
4.1.2	Research and development	23
4.1.3	Awareness raising and capacity building	24
4.1.4	Development of policies and instruments	24
4.2	Recommendations	24
4.2.1	Widening the understanding of agricultural biodiversity	25
4.2.2	Increasing recognition of the essential contribution of agricultural biodiversity in all product systems	25
4.2.3	Improving integration and coordination of activities and processes for sustaining agricultural biodiversity, productivity and agro-ecosystem functions	26
 CASE STUDIES		
1	Enhancing soil biodiversity in intensive crop production through conservation tillage, Brazil	9
2	Sustainably using agricultural biodiversity through integrating soil and pest management in diverse farming systems, Senegal	14
3	Promoting on-farm conservation of Andean tubers through agro-ecotourism, Peru	16
4	Improving agricultural biodiversity functions in intensive rice production through IPM and Aquatic Life Management, Viet Nam	17
5	Rebuilding the endangered Aubrac cattle breed through niche marketing of cheese, France	20
6	Increasing biodiversity conservation within coffee landscapes through eco-labelling, El Salvador	21
 ANNEXES		
I	Agenda	
II	List of Participants	
III	Analytical Matrix	
IV	Priority Issues identified during the workshop	
V	Analysis of required actions	

Acronyms

CAP	Common Agriculture Policy (EU)
CBD	Convention on Biological Diversity
CGIAR	Consultative Group on International Agricultural Research*
CGRFA	Commission on Genetic Resources for Food and Agriculture (FAO)
CHM	Clearing-House Mechanism (CBD)
COAG	Committee on Agriculture (FAO)
COP	Conference of the Parties (CBD)
CSD	Commission on Sustainable Development (UN)
CTE	Committee on Trade and Environment (WTO)
EIA	Environmental Impact Assessment
EC	European Commission
EU	European Union
GATT	General Agreement on Tariffs and Trade
GEF	Global Environment Facility
GIS	Geographic Information Systems
GMO	Genetically Modified Organism
GOs	Governmental Organizations
GPA	Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (FAO)
ICIPE	International Centre for Insect Physiology and Entomology
IFOAM	International Federation of Organic Agriculture Movements
IPGRI	International Plant Genetic Resources Institute (CGIAR)
IPM	Integrated Pest Management
IPNS	Integrated Plant Nutrient Systems
IPRs	Intellectual Property Rights
ITDG	Intermediate Technology Development Group
IU	International Undertaking on Plant Genetic Resources [for food and agriculture]
IUCN	World Conservation Union
NGOs	Non-Governmental Organizations
OECD	Organisation for Economic Co-operation and Development
PBRs	Plant Breeders' Rights
PGR(FA)	Plant Genetic Resources (for Food and Agriculture)
PIC	Prior Informed Consent
PVP	Plant Variety Protection
RS	Remote Sensing
SBSTTA	Subsidiary Body for Scientific, Technical and Technological Advice (CBD)
SCBD	Secretariat to the Convention on Biological Diversity (CBD)
TRIPs	Trade Related Aspects of Intellectual Property Rights (GATT/WTO)
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPOV	International Convention for the Protection of New Varieties of Plants
WB	World Bank
WFS	World Food Summit (FAO)
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

*The 16 CGIAR centres include the International Potato Institute (CIP), International Centre for Research on Agroforestry (ICRAF), International Rice Research Institute (IRRI) and IPGRI.

1 Introduction

1.1 BACKGROUND

Agricultural biodiversity¹ is essential for global food production, livelihood security and sustainable agricultural development. The plant, animal and microbial organisms important to food and agriculture must be conserved and used sustainably if, as is required for universal food security, sustainable food production is to be achieved across the whole range of agro-ecosystems and production systems. This has been recognized not only by FAO but also by the Parties to the Convention on Biological Diversity (CBD) and many other organizations from global to local levels.

Governments, international organizations and non-governmental organizations have, therefore, initiated a process to ensure that agricultural biodiversity issues will constitute an integral part of their respective policies, plans and programmes in the fields of agriculture,² environment and natural resources management. Accordingly, FAO together with the CBD Secretariat, and with the support of the Government of the Netherlands, organized this international technical workshop to support the complementary and parallel processes of these two inter-governmental bodies.

This current workshop is a follow-up to the first technical workshop, held in June 1997, which was also organized jointly by FAO and the CBD Secretariat with the support of the Government of the Netherlands. The report of the initial workshop entitled “Farming Systems Approaches for the Sustainable Use and Conservation of Agricultural Biological Diversity and Agro-Ecosystems”³ was welcomed by the Conference of Parties of the CBD.

As outlined in its report, the first workshop identified the need for cooperative and integrated approaches among all relevant actors, institutions and focal points at national and international levels to: *increase information and awareness, provide guidance for conducting and harmonizing assessments of resources and relevant sectoral and cross-sectoral capacities and priorities, and identify and enhance the effectiveness of relevant legal and policy instruments and mechanisms.*

1.2 PURPOSE OF WORKSHOP

Focusing on agro-ecosystems and production systems levels, the workshop helped to identify the main elements required to provide enabling environments and technical, policy, institutional and legal incentives, from global to local levels, for the conservation and sustainable use of agricultural biodiversity. Emphasis was placed on the following:

- Identifying possible mechanisms (approaches and incentives) for developing and promoting integrated, biodiversity-supporting efforts and actions at agro-ecosystem level in particular those that optimize cooperation and synergies between agricultural and environmental sectors and subsectors and between the diverse actors.

¹ “Agricultural biodiversity”, the term used throughout this report, is synonymous with “agricultural biological diversity” as used in decisions III/11 and IV/6 of the COP.

² The use of the term “agriculture” in this report includes all types of food and agricultural production, *inter alia*, crop and livestock husbandry, fisheries and forestry.

³ See (UNEP/CBD/SBSTTA/ 3/Inf.10).

- Contributing to the analysis of ongoing activities and instruments addressing agricultural biological diversity using tools, such as an analytical matrix,⁴ to facilitate the synthesis of information and, through this and other methods, the identification of criteria for setting priorities.

The workshop was designed to achieve four objectives:

- To stimulate work at country level and within institutions that will contribute to the conservation and sustainable use of agricultural biodiversity through the implementation of COP decisions III/11 and IV/6.
- To provide expert advice to FAO and the CBD on the assessment of ongoing activities and instruments on agricultural biodiversity with a view to facilitating SBSTTA's consideration and development of recommendations regarding priorities for the Convention's work programme on agricultural biodiversity.
- To assist FAO and the CBD to identify complementary and synergistic programmes in their joint work programme, and through partnerships with other organizations, with a view to strengthening work on agricultural biodiversity and the ecosystem approach.
- To contribute to the FAO-Netherlands Conference on the Multifunctional Character of Agriculture and Land and other meetings that will feed into the FAO Conferences and CSD-8.

The workshop agenda is attached in Annex I.

1.3 WORKSHOP PROCESS

Over 60 participants attended, including 18 female experts, representing 20 countries in all regions and 15 international and regional organizations (see Annex II). The national experts were selected jointly by the organizing bodies using the roster of experts set up by the Conference of the Parties to the Convention. They were supplemented by regional experts and representatives nominated by international organizations and associations. The participants' experiences and expertise covered a wide range of scientific and technical expertise in the area of agricultural biodiversity including the main thematic areas: plant, animal and microbial genetic resources; wildlife important for food and agriculture; land resources and ecosystem management; farming systems development; traditional knowledge systems and community/participatory processes; and food security and market issues.

In preparation for the workshop, case studies had been collected, covering a wide range of agro-ecosystems all over the world. Eight participants presented a selection of these. Six case studies are summarized in this report. Further background materials were provided by the organizers and participants. The case studies and materials presented experiences, lessons learned and best practices in the development of approaches and incentive measures in different agro-ecosystems and in different regions of the world.

The participants identified key problems and prioritized issues and those areas of intervention which provide opportunities for making substantial achievements and for overcoming major constraints and obstacles to the conservation of agricultural biodiversity, especially regarding the maintenance and sustainable use of agro-ecosystems and the promotion of sustainable agricultural practices and technologies.

The workshop concluded with the signing of the cover letter (see pages iii and iv) to this current report by FAO, SCBD and the Government of the Netherlands addressed to all Members of FAO, Parties to the

⁴ The "Matrix" (see Annex III) was developed by FAO and SCBD to assist in the analysis and synthesis of relevant ongoing activities and instruments as reported by governments and international and regional organizations.

CBD and to Country Representatives and Observers to the UN Commission on Sustainable Development (CSD).

1.4 STRUCTURE OF THIS REPORT

Having summarized the background, purpose and process of the workshop, this report then provides the context, terms and concepts considered during the workshop. Section 3 of the report summarizes the discussions and results of the workshop under four broad headings: Information, assessment and indicators; Research and development; Awareness and capacity building; and Development of policies and instruments. Finally, Section 4 summarizes the major conclusions and recommendations that were identified at technical and policy levels by the workshop.

2 Workshop context, terms and concepts

2.1 CONTEXT

*Evolution of thinking about agricultural biodiversity*⁵

The understanding of agricultural biodiversity has developed during the last three decades (see figure opposite) from the recognition of the importance of genetic diversity, particularly for crops, and an emphasis on the *ex situ* approach in the 1970s to the adoption of the *in situ* approach in the 1990s and now to the development of the agro-ecosystem approach.

The Integrated Rural Development (IRD) concept of the 1970s, with its emphasis on providing complete input packages for seeds, agro-chemicals, irrigation, mechanization, credit, extension, etc., did not recognize that genetic resources and the wider agricultural biodiversity were also relevant at the production system and the agro-ecosystem levels. However, with the establishment of the Commission on Plant Genetic Resources (CPGR) in 1983, an important milestone, it was recognized for the first time that genetic resources were a concern for humankind, requiring concerted intergovernmental action. This coincided with the introduction of the Sustainable Agriculture and Rural Development (SARD) concept, which recognized the need to integrate environmental and production goals. Several other organizations, such as the World Conservation Union (IUCN), had been developing policies and programmes for integrating nature conservation with agriculture, especially in Western Europe, since the early 1970s. This development of ideas culminated in the Conference on Environment and Development (UNCED) in 1992, in preparation for which the 1991 Den Bosch Conference, organized by FAO and the Government of the Netherlands, played a very significant role.

After UNCED, the CPGR was renamed the Commission for Genetic Resources for Food and Agriculture (CGRFA) in order to reflect its expanded mandate to include forest, animal, fish and other genetic resources, including bacteria and soil biota essential for food and agriculture. Even though the scope was still on a genetic and species level, this was the first step towards developing the ecosystem approach. Subsequently the Leipzig Conference in 1996⁶ helped to translate some of these concepts, such as the *in situ* approach, into priority activities specifically for the conservation and sustainable use of plant genetic resources for food and agriculture.

Today, the focus is on developing the ecosystem approach. There is a need to consider which elements are an appropriate unit of analysis for agricultural biodiversity in agro-ecosystems, what is an appropriate scale and what is an appropriate set of indicators. There is need for an integrated and holistic approach, linking the genetic level, the species level and farm and agro-ecosystem level.

In May 2000 the eighth session of the Commission on Sustainable Development (CSD-8) will be convened in New York. This will be the first time that ministers of agriculture and ministers of environment will be invited jointly to discuss issues of land and agriculture.

Owing to the theme and its former role as a task manager for the relevant chapters in Agenda 21, FAO, with help from the Government of the Netherlands, is taking a lead in preparing for CSD-8. In this regard, the FAO/Netherlands Conference on the Multifunctional Character of Agriculture and Land will be held in September 1999 in the Netherlands.

⁵ Adapted from the presentation made by Louise Fresco (FAO) during the workshop.

⁶ The Leipzig Conference on the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture, resulting in a Global Plan of Action (GPA).

The workshop in relation to COP Decisions III/11 and IV/6⁷

Decision III/11 of the Conference of the Parties (COP) to the Convention on Biological Diversity (CBD)⁸ recognizes the importance of the conservation and sustainable use of agricultural biological diversity. It addresses (i) genetic and species diversity, and (ii) the wider issue of ecosystems and habitats as follows: the ecosystem approach; the integrated, multi-disciplinary land-use approach (resources planning, development and management); and the holistic systems approach to address the multiple objectives of SARD (land-use pressures and resource degradation, management of animal, plant and microbial diversity, and management of land and water resources, air and climatic factors, and wildlife habitats).

COP decision III/11 has three main target groups and areas of attention. Firstly, the COP requests FAO and the CBD Secretariat to conduct the assessment of ongoing activities and instruments at international and national levels based on contributions, including the exchange of case studies, by governments and international and regional organizations. This assessment will assist the COP, upon the advice and recommendations of SBSTTA, in setting priorities for its multi-year programme of work on agricultural biological diversity while avoiding unnecessary duplication of efforts. Secondly, the COP outlines the actions that Parties are encouraged to conduct through the development of national strategies, programmes and plans, with the support of international and regional bodies. Thirdly, the COP notes and encourages relevant work and contributions of key organizations, notably of FAO, the Global Environment Facility (GEF), the World Trade Organization (WTO) and the Clearing-House Mechanism (CHM) of the Convention.

Decision IV/6, agreed upon at the fourth COP, emphasized (in its fourth paragraph) the following focus for efforts by Parties and all relevant actors:

“Governments, funding agencies, the private sector and non-governmental organizations should join efforts to identify and promote sustainable agricultural practices, integrated landscape management of mosaics of agriculture and natural areas, as well as appropriate farming systems that will reduce possible negative impacts of agricultural practices on biological diversity and enhance the ecological functions provided by biological diversity to agriculture.”

While the issue of agricultural biodiversity is being addressed as a distinct thematic area under the Convention, in view of its distinctive features and problems needing distinctive solutions (COP decision II/15), it is also cross-cutting in the sense that it is important to all habitable ecosystems. It addresses genetic resources important to food and agriculture in marine and coastal, forest, inland waters, Mediterranean and mountain ecosystems, as well as in drylands, grassland and savannahs, for which work programmes have been or will be established in the framework of the CBD.

In January 2000 in preparation for the 5th Conference of the Parties to the CBD in May 2000, SBSTTA will consider the results of the assessment of ongoing activities and instruments on agricultural biodiversity, and the identification of priority issues and areas of attention, which is being prepared jointly by FAO and the CBD Secretariat, with a view to facilitate its development of recommendations regarding priorities for the further development of the CBD work programme on agricultural biological diversity.

⁷ Adapted from the presentation made by Sally Bunning (CBD) during the workshop.

⁸ UNEP/CBD/COP/3/38: Report of the third Conference of the Parties (Buenos Aires, November 1996) and its decisions.

2.2 TERMS AND CONCEPTS

The meaning of the terms **agricultural biodiversity** and **agro-ecosystems** have not been precisely defined by the COP in consultation with FAO; however, the workshop was presented with some background materials which set the scope for the use of these terms.

Although the term “agricultural biodiversity” is relatively new – it has come into wide use in recent years as evidenced by bibliographic references – the concept itself is quite old. It is the result of the careful selection and inventive developments of farmers, herders and fishers over millennia. Agricultural biodiversity is a vital sub-set of biodiversity. It is a creation of humankind whose food and livelihood security depend on the sustained management of those diverse biological resources that are important for food and agriculture. It includes:

- species used directly or indirectly for food and agriculture, both for human nutrition and as feed for domestic animals, and the provision of essential raw materials and services such as fibre, fertilizer, fuel and pharmaceuticals;
- habitats and species outside of farming systems which can benefit agriculture and enhance ecosystem functions. It covers, *inter alia*, crop varieties (including forage and fodder plants and trees) animal breeds (including fish, molluscs, bird species and insects) as well as fungi, yeasts and micro-organisms;
- ecological complexes of which the cultivated crops and reared animals form a part, such as field margins, copses and fallow land, as well as wild relatives and also other non-harvested species that provide for the needs of, for example, pollinator species and beneficial predators.

Agricultural biodiversity refers to the variety and variability of animals, plants, and micro-organisms on earth that are important to food and agriculture which result from the interaction between the environment, genetic resources and the management systems and practices used by people. It takes into account not only genetic species and agro-ecosystem diversity and the different ways land and water resources are used for production, but also cultural diversity, which influences human interactions at all levels. It has spatial, temporal and scale dimensions. It comprises the diversity of genetic resources (varieties, breeds, etc.) and species used directly or indirectly for food and agriculture (including, in the FAO definition, crops, livestock, forestry and fisheries) for the production of food, fodder, fibre, fuel and pharmaceuticals, the diversity of species that support production (soil biota, pollinators, predators, etc.) and those in the wider environment that support agro-ecosystems (agricultural, pastoral, forest and aquatic), as well as the diversity of the agro-ecosystems themselves.

Agricultural biodiversity has been further described as including:

- harvested crop varieties, livestock breeds, fish species and non-domesticated “wild” resources within field, forest, rangeland and aquatic ecosystems;
- non-harvested species within production ecosystems that support food provision, including soil micro-organisms, pollinators, etc.;
- non-harvested species in the wider environment that support food production ecosystems (agricultural, pastoral, forest and aquatic ecosystems).

A particular contribution by this workshop is the description of agricultural biodiversity in terms of a concept that could be applied at all scales, production systems and agro-ecosystems whereby ***agricultural biodiversity encompasses the variety and variability of animals, plants and micro-organisms which are necessary to sustain key functions of the agro-ecosystem, its structure and processes for, and in support of, food production and food security.***

Agricultural ecosystems (or **agro-ecosystems**) are those "ecosystems that are used for agriculture" in similar ways, with similar components, similar interactions and functions. Agro-ecosystems are determined

by three sets of factors: the genetic resources, the physical environment and the human management practices, which exhibit genetic, spatial and temporal variation, as well as by their interactions. There are virtually no ecosystems in the world that are "natural" in the sense of having escaped human influence. Most ecosystems have been to some extent modified or cultivated by human activity for the production of food and income and for livelihood security.

Agro-ecosystems may be identified at different levels or scales, for instance, a field/crop/ herd/pond, a farming system, a land-use system or a watershed. These can be aggregated to form a hierarchy of agro-ecosystems. Ecological processes can also be identified at different levels and scales. Valuable ecological processes that result from the interactions between species and between species and the environment include, *inter alia*, biochemical recycling, the maintenance of soil fertility and water quality and climate regulation (e.g. micro-climates caused by different types and density of vegetation). Moreover, the interaction between the environment, genetic resources and management practices determines the evolutionary process which may involve, for instance, introgression from wild relatives, hybridization between cultivars, mutations, and natural and human selections. These result in genetic material (landraces or animal breeds) that is well adapted to the local abiotic and biotic environmental variation.⁹

Agro-ecosystems comprise polycultures, monocultures, and mixed systems, including crop-livestock systems (rice - fish), agroforestry, agro-silvo-pastoral systems, aquaculture as well as rangelands, pastures and fallow lands. Their interactions with human activities, including socio-economic activity and sociocultural diversity, are determinant.

Some of the key functions for maintaining stable, robust, productive and sustainable agro-ecosystems may include the following:

- breakdown of organic matter and recycling of nutrients to maintain soil fertility and sustain plant and consequently animal growth;
- breakdown of pollutants and maintenance of a clean and healthy atmosphere;
- moderation of climatic effects such as maintaining rainfall patterns and modulation of the water cycle and the absorption of solar energy by the land and its subsequent release;
- maintenance and stability of productive vegetative, fish and animal populations and the limitation of invasion by harmful or less useful species;
- protection and conservation of soil and water resources, for example through a vegetative cover and appropriate management practices, and the consequent maintenance of the integrity of landscapes and habitats;
- sequestration of CO₂ by plants.

⁹ For further details and definitions, especially of the abiotic or physical/ecological environment, agricultural biological/genetic resources, management practices and relevant sociocultural variables, see the report of the first workshop (UNEP/CBD/SBSTTA/ 3/Inf.10).

3 Workshop results

The priority issues identified by participants (see Annex IV) were selected through discussions on: relevant COP decisions, including those addressing incentive measures, the ecosystem approach and sustainable use; the ongoing analysis of activities and instruments relevant to the conservation and sustainable use of agricultural biodiversity; the case studies provided to the workshop; and participants' own experiences.

In the context of the three principal dimensions of agricultural biodiversity, the sustainable production of food and other agricultural products, the provision of biological or life support to production as well as ecological and social services provided by agro-ecosystems, the *opportunities, actions, mechanisms and linkages* were finally brought together under four main headings, as outlined below:

- Information, assessment and indicators
- Research and development
- Awareness raising and capacity building
- Development of policies and instruments

3.1 INFORMATION, ASSESSMENT AND INDICATORS

3.1.1 Exchange of and access to information

Opportunities

Many bodies, especially research institutions and NGOs, are involved in the collection and dissemination of information on relevant agricultural biodiversity issues. Most of the information is held locally in agricultural communities and by local organizations and refers to certain scales of intervention, e.g. a watershed or a production system, is relevant to specific sectors, e.g. agricultural production or environmental conservation, and focuses on certain actors, e.g. small- or large-scale farmers or herders. There is need for a greater flow of information between different levels of intervention, different sectors and different actors (see Case study 1).

Actions

The workshop identified the urgent need to facilitate the exchange of information between different actors and stakeholders while putting in place mechanisms to access information held by local and indigenous communities, by means of research and development organizations through some form of CBD Clearing-House Mechanism (CHM) or networks.

Mechanisms and linkages

It was felt that through electronic means – e-mail, listservers, Internet – low-cost options for information exchange could be developed both informally through spontaneous initiatives as well as formally through the use, for example, of web sites and information dissemination mechanisms of institutions such as FAO, CBD and CGIAR. However, it was recognized that the mechanisms for driving information through these systems need to be enhanced and appropriate capacities developed.

Case study 1

Enhancing soil biodiversity in intensive crop production through conservation tillage, Brazil*

Productivity, income and agricultural biodiversity gains resulting from the widespread uptake of conservation tillage. In Santa Catarina, Brazil, the soil was traditionally tilled using conventional means (sometimes on steep hills) but now, owing to the widespread uptake of conservation tillage, there is a well managed landscape, achieved by simply leaving more cover on the soil. Farmers, with the same tools they used traditionally, now open only the planting furrow, instead of tilling the entire field. The crop establishes itself between the rows of crop residues which, through the organic matter, provide a conducive environment for soil biodiversity.

Conservation tillage is defined as any tillage or planting system in which more than 30% of the soil surface is covered with crop residues after planting. Zero tillage, also a form of conservation tillage, is sometimes used synonymously. This reduces soil erosion and provides material for biological tillage, which builds up soil biodiversity and organic matter that, in turn, stabilizes the soil structure and improves water infiltration. Its benefits are not only in production, through improved yields and lower maintenance requirements for farm equipment, but also to the wider environment through improved water quality owing to less erosion and more regular flow of streams from better infiltration and soil moisture storage and reduced losses of applied inputs in run-off. Conservation tillage results in 70% less herbicide run-off, 93% less erosion and 69% less water run-off as compared with mould-board or disc-ploughing. There is also reduced release of carbon gases and reduced air pollution.

The uptake of conservation tillage in Santa Catarina was successful because of well organized farmer groups, who developed the necessary technologies, together with scientists, technicians and the private sector, and farmer-to-farmer extension. A high level of management skills is required to achieve successful transition from conventional to conservation tillage systems including the ability to deal with: the rehabilitation of degraded soils to a level where soil life can prosper; the effect of surface plant residues on planting equipment; the different timing and ways of application of fertilizers through the surface cover; and the initial increases in weed populations and greater herbicide use.

As a result of the uptake of conservation tillage in Santa Catarina, there has been a sustainable increase in production of maize and wheat with yields up by more than 200%. Similar results have been recorded in the rest of Brazil as well as in other countries in Africa and Asia. Large areas of Brazil's soya crop are now under zero tillage systems. It is estimated that about 1.93 million households in 20 countries now have more than 4 million ha of land under conservation tillage with significant improvements in production and agricultural biodiversity at all levels.

** Adapted from case study presentations by José Benites and Theodor Friedrich, FAO, and Helvecio Mattana Saturnino, President of APDC (the Zero Tillage Association of the Cerrados), Brazil.*

Special attention should be given to communications with and between local farmers, herders and fishers whose knowledge, innovations and practices are recognized as essential for the conservation and sustainable use of agricultural biodiversity. In this regard, the work of NGOs and locally focused research programmes was commended. The information generated by such programmes was seen to have great value. It was recognized that better and more sustainable use of this information is necessary. The workshop considered what might be appropriate mechanisms for the exchange and generation of required knowledge, information and understanding, including the use of systems like the FAO Global Plant Protection Information System (GPPIS).

3.1.2 Assessment and indicators

Opportunities

The scientific, institutional and political pressures to understand better how to measure the conservation and sustainable use of agricultural biodiversity, the changes in resource stocks and the influences that bear on these, are gaining momentum. In particular the growing concern over the impacts of modern agricultural practices on agricultural biodiversity is providing increasing opportunities to carry out important work in this area.

The identification of agro-ecosystem-specific indicators and the use of these for assessment, monitoring and understanding the causes of changes in agricultural biodiversity is recognized as a priority issue. This requires the development of effective tools and methodologies which can be used in such a way as to promote practical actions that mitigate the harmful and enhance the positive impacts of agriculture on biological diversity.

The need was identified for the development of rapid assessment methodologies for assessing the status and trends of agricultural biodiversity in different production systems and agro-ecosystems. The application of such methodologies could start with those systems that appear to be the most threatened and/or the most valuable for present and future generations.

Actions

The workshop suggested two main areas on which to focus the development of indicators for assessment and monitoring of agricultural biodiversity in ecosystems as follows:

Assessments of landscape/watershed and agro-ecosystem/production system levels

- Identification and monitoring of key indicators, scalable between levels where possible, for specific environmental functions and agro-ecosystem multi-functionality, interactions, resilience and sustainability (e.g. for soil biota, pollinators, predators, soil erosion, water quality, wild relatives).
- Identification and monitoring of key indicators to include critical economic, ecological, spatial and social (including demographic) factors at all scales, for example, the work of CONABIO in Mexico, the OECD working group on agri-environmental indicators and work currently being done by FAO.
- Monitoring and understanding of short- and long-term impacts of agricultural practices/ technologies on the environment at landscape/watershed and agro-ecosystem/production system levels, facilitated through the use of GIS and other remote sensing tools. In intensive agricultural systems, in particular, the impacts on the status and trends of the totality of agricultural biodiversity should be monitored, especially below ground and in field margins and landscape areas.
- Research and identification of key environmental functions/processes for different agro-ecological areas/production systems to be carried out with the full participation and involvement of local communities and civil society utilizing community-based natural resources management principles.
- Identification of key habitats (threatened and neglected) and key species (threatened, neglected and under-utilized crops, wild relatives of domesticated species, wild sources of food).
- Application of environmental and/or biodiversity impact assessment of agricultural practices at farm and landscape levels.

Such activities for the identification and development of indicators and assessment methodologies require the collaboration of all stakeholders, building wherever possible on local/traditional knowledge systems and practices and their assessment criteria. They should include long- and short-term assessments at multiple levels, and should allow comparison, where possible, of the impacts of distinct interventions.

Assessments of economic forces that influence agricultural biodiversity sustainable production and food and livelihood security

In view of the decisive impact of economic forces, there is a need to identify, assess and monitor activities which may allow for profitability of sustainable agricultural practices, while sustaining agricultural biodiversity through, for example, the following:

- Assessing both positive and negative externalities in investments, incomes and prices, with a view to internalizing these. The constraints to this include: lack of data (especially information related to environmental multi-functionality and safe minimum standards values); difficulties in synthesizing complex information in agro-environmental indicators and translating this ecological information into economic language; and difficulties of assessment and monitoring of safe minimum standard values, requiring new skills and greater awareness of all actors from farmers to governments.

- Identifying (qualitative) and measuring (quantitative) environmental and economic indicators which define the performance of environmental functions by agro-ecosystems through the assessment of safe minimum standard values.
- Assessing the economic value of agricultural practices which maintain or enhance (positive externalities) or diminish (negative externalities) the performance of environmental multi-functionality by agro-ecosystems.
- Identifying, assessing and monitoring incentives (for example, legal, land tenure, niche markets, certification of sustainable practices/technologies) which may have positive or negative impacts on the economic performance of the agricultural sector and systems (i.e. value added) through government intervention (taxes, subsidies) or market mechanisms.
- Assessing environmental accounting systems (in physical, monetary and energy units of measurement) capable of eliciting impacts of the agricultural sector on conservation and sustainable use of agricultural biodiversity and also impacts of other economic sectors on natural resources and environmental functions used by farmers (through inter-sectoral analysis).
- Assessing global benefits of agricultural biodiversity conservation and sustainable use compared with local costs accruing in achieving them (including the import/export of environmentally positive/negative externalities in international agricultural trade).

Mechanisms and linkages

Many activities have been planned or are in progress. Noteworthy are the activities of the CGIAR in developing methods and indicators both sectoral and for a wide range of agro-ecosystems and, in particular, its system-wide initiative on “functional agricultural biodiversity”. The activities of many organizations, such as WRI, IUCN, UNDP, UNEP, FAO and OECD, include the development of indicators and assessment methodologies.

3.2 RESEARCH AND DEVELOPMENT

The workshop considered how relevant new knowledge is generated through research and development, how organizations, communities and individual producers can build on knowledge, innovations and practices and what kinds of improvements in capacity are required to achieve lasting benefits. This discussion was held in the context of participants’ awareness that resources are dwindling for public sector work but are growing significantly within the private sector.

The workshop recognized that there is a need for greater attention to support the adaptation and development of appropriate technologies for different production environments and different agro-ecological zones taking into account the socio-economic context. This could be achieved through participatory research with the involvement of local communities and scientists in the South utilizing South-South and South-North linkages. There is also a need to promote increased research and development directed towards intensive production systems in high potential areas as well as towards biodiversity “hotspots” and fragile ecosystems, which are considered marginal for agricultural production but important for populations in these areas who rely on the natural biological and physical resources for their livelihood and food security.

Opportunities

The research and development programmes of many international, national and local organizations already have focused activities in areas of agricultural biodiversity at agro-ecosystem and production system levels, including those that address the agriculture-environment interface and those concerning integrated or multi-disciplinary resource management approaches. This has been illustrated by the diverse and numerous contributions to the workshop and the ongoing assessment.

Many relevant research and development activities are under way or planned, but coordination and information sharing between them was noted as important. However, it was also noted that the

development and dissemination of appropriate technologies, research and resources is often not prioritized and that Southern countries, in particular, have less access to what they require and less opportunity to agree on priorities for resource allocation.

Actions

In regard to research and development the workshop identified three main issues to work on: *ecosystem approaches and ecosystem functions*, specific research areas such as *soil biota, pollinators and predators* and *threats and positive incentives* for agricultural biodiversity.

The ecosystem approaches and ecosystem functions

An important action is the development of methods and technologies for applying an ecosystem approach through the review of current research programmes to ascertain to what extent and how current research on agriculture looks at the environmental aspects and impacts of agriculture. This builds on the Malawi Principles¹⁰ and decision IV/1.

The development of methods of ecosystem research should not be seen as some sort of sectoral or focused environmental research, but as a wider and more holistic research that draws upon a number of disciplines. For example in the fisheries sector, research should include not only fish stocks assessment but marine ecosystem research and relevant environmental research.

A priority area for further investigation is to increase understanding of the relationship between agriculture (the production system and practices) and agricultural biodiversity at agro-ecosystem level. There are a multitude of types of agro-ecosystems and production systems and the precise relationships vary from one locality to another as a result of the complexity of interlinking social, economic and environmental variables. Therefore, it was noted that such research would require appropriate indicators and rapid assessment methodologies in order to identify important issues and trends.

The workshop considered that there is a need to establish guiding principles that help identify which species and their interactions are most critical to the health, stability and functioning of the different agro-ecosystems and production systems throughout the world. This may include:

- the identification of keystone or critical species which provide vital functions;
- the identification of those biodiversity components which have a biological or life support function in the agro-ecosystem essential for both agricultural production and nature conservation;
- the effects of the addition or loss of a dominant or abundant species on the ecosystem character and function in different production systems;
- the identification of rare or minor species, which today may be considered expendable, that have the potential to take over key ecosystem functions if and when other species are lost;
- the impacts of a change (addition or loss) in one species on other species and on ecosystem functions resulting from cascading interactions between species.

Soil biota, pollinators and predators

The workshop confirmed that soil biota and pollinators, as outlined in decision III/11 and IV/6, as well as predators are of great importance to the conservation of natural ecological processes and the maintenance of sustainable and productive agricultural systems and that they deserve greater attention and understanding. Not only are their interactions and related ecological functions and processes little known, but these are seen to provide an entry point for joint work between ecologists and agriculturalists, with support from social scientists as necessary.

Threats and positive incentives

¹⁰ See UNDP/CBD/COP/IV/Inf. 9.

The workshop identified the following as primary action points for research and development:

- improvement of knowledge of the status and trends of agricultural biodiversity in key farming systems;
- identification of the forces behind changes in farming systems that lead to threats to (or negative impacts on) agricultural biodiversity;
- identification and use of indicators of agricultural biodiversity to facilitate research work in these two areas;
- development of mechanisms to use or exploit market forces through consumer surveys and also standardization and best practices for eco-labelling.

Mechanisms and linkages

Many relevant activities for which the research findings can be shared and further built upon are under way or planned. Examples of relevant programmes and relevant actions focusing on research and development at ecosystem level, include:

- the CGIAR system-wide “functional agricultural biodiversity” initiative, IPGRI’s *in situ* conservation project;
- the Tropical Soils Biodiversity and Fertility programme, programmes of DIVERSITAS on agro-ecosystems and “wild” plants for food and agriculture;
- many NGO research, development and extension activities with local communities in, for example, Brazil (AS-PTA), Zimbabwe (Sorghum Landrace Study), Kenya (ITDG’s on-farm maintenance of PGRFA) and in many other countries, as recorded in *Cultivating Diversity* by Lori Ann Thrupp, WRI (see Case study 2);
- actions to implement the Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (GPA);
- actions to implement the Global Strategy for the Management of Farm Animal Domestic Diversity.

Case study 2

Sustainably using agricultural biodiversity through integrating soil and pest management in diverse farming systems, Senegal*

Increasing yields by using diverse, regenerative farming and animal husbandry methods is being promoted through effective partnerships. The purpose of this initiative was to respond to the concern of the smallholder farmers for a system that would regenerate degraded soils, increase production and maintain an ecological balance through the use of integrated pest management techniques. The techniques employed include: the use of large applications of compost and livestock manure, up to 2 tonnes/ha; intercropping of legumes and crop rotations to build up soil organic matter, water retention, nutrient balance and health in order to increase resistance to soil-borne pathogens and insect pest populations and to provide a more nutritive and drought-tolerant environment for the root systems of crop plants. Production of crops, vegetables and fruits as well as livestock was increasingly integrated. In parallel, chemical fertilizer and pesticide applications were reduced or eliminated and the use of organic and cultural alternatives, such as applications of Neem extracts, was increased.

This is being achieved through effective partnerships and two-way exchanges of information between farmers, NGOs, extensionists and scientists who together, under the direction of the communities, select techniques and methods of implementation. Farmers monitor results and share this information with others in order to assess impacts. These include increased yields and income from grains, vegetables and livestock, for example, millet yields have shown increases of 400 kg/ha; reduced costs for chemical inputs; and greater organization and empowerment of farmers’ groups. However, differing institutional objectives, lack of open dialogue between actors and struggles for control at a local level are constraints that need to be overcome. The outcome of this initiative has shown that integrated methods have restored soil and plant health, increased yields and incomes and improved conservation of resources needed for sustainable production.

**Adapted from a case study on the Senegal Regenerative Agricultural Resource Centre, Gad Khaye, which works with the Rodale Institute, presented by Lori Ann Thrupp, WRI.*

The workshop tested a simple schema for reviewing case studies using the examples that focused on enhancing agricultural biodiversity and production in intensive production systems. The further

development of such an analytical process could be very useful with a view to identifying those technologies and practices which deserve to be promoted for agricultural biodiversity conservation and sustained productivity (see Annex V).

The use of participatory processes, which build on local knowledge, innovations and practices that have been acquired over generations of research experience and adaptation by the resource users, is considered important and will enhance and validate research findings.

3.3 AWARENESS RAISING AND CAPACITY BUILDING

Opportunities

Despite the activities and actions of FAO, CBD and many expert institutions at all levels, including those represented in the workshop, and the decisions and actions of the countless millions of farmers, herders and fishers, one of the key issues raised was the lack of awareness of the value and importance of agricultural biodiversity, especially at the agro-ecosystem level. In particular it was generally agreed that those who have decisive impacts on the food system, from politicians and directors of corporations to producers and consumers, need to become more aware of the multifunctional character of agriculture and the links between agricultural biodiversity, sustainable production, environmental management as well as food and livelihood security.

An opportunity exists for greater awareness raising of consumers so that the market demand becomes oriented towards and favours products emanating from biodiversity friendly production systems. To promote a shift towards environmentally sensitive agro-ecosystems actually requires mutual understanding and feedback between both sets of actors: the producers and the consumers as has been generated with regard to organic production methods throughout the world.

Arising from this lack of awareness, a number of needs were identified as follows:

- to have clearer definitions and explanations of terminologies;
- to agree upon a clear overarching framework for policies, plans and programmes for agricultural biodiversity based on its dimensions for sustainable food and agriculture production and the provision of biological or life support to production as well as ecological and social services;
- to collect, exchange and integrate data at different levels regarding different components of the ecosystem to ensure a holistic view;
- to develop effective linkages between sectors and institutions to ensure the development of synergetic and complementary approaches and be able to exchange information about mutually agreed common issues;
- to disseminate, or develop as necessary, improved research methods, especially for the study of agro-ecosystems.

Actions

In regard to awareness raising and capacity building the workshop suggested actions for the following areas: *capacity building to improve awareness, knowledge and information* on agricultural biodiversity, *capacity building to disseminate sustainable methods* for agricultural biodiversity conservation and *capacity building for decision-making and planning and policy-making* on agricultural biodiversity.

Capacity building to improve knowledge and information on agricultural biodiversity

- i. Developing participatory (hands-on) and integrated training, and non-farm multidisciplinary education processes, including the training of trainers, and the development of curricula and structures to facilitate this.
- ii. “Re-educating” formal professionals and institutions (universities, NARS, IARCs, etc.) to include, *inter alia*, agro-ecology, ecosystem functions, agricultural biodiversity, participatory approaches and techniques, incorporating local knowledge and local producers, when possible.
- iii. Educating policy-makers through field visits and through feedback on impacts of practices.
- iv. Integrating and coordinating stakeholders to share knowledge and information on agricultural biodiversity.
- v. Improving education (hands-on) of schoolchildren and university students on agricultural biodiversity and agro-ecology (see Case study 3).
- vi. Building awareness among consumers, retailers and suppliers (create market demand for products emanating from biodiversity-friendly production systems).
- vii. Recognizing and validating local indigenous knowledge systems used for agricultural biodiversity conservation and sustainable use.
- viii. Developing and promoting the use of Geographical Information Systems for collecting and analysing multivariate data, for monitoring and assessing trends and for looking from a holistic point of view at production systems and their impacts on the wider environment.
- ix. Developing and promoting the use of improved information and communications technology for sharing and assessing experiences and for addressing the findings through appropriate and targeted messages, especially through South-South information sharing.

Case study 3

Promoting on-farm conservation of Andean tubers through agro-ecotourism, Cusco, Peru*

A new incentive for on-farm conservation of Andean crops is being provided through the development of agro-ecotourism. Cusco is important for tourism in Peru because it is the centre of pre-Hispanic Inca culture; however, the rural population benefits only marginally. One source of income is through the sale of their produce, mostly derived from the unique biological resources of the region. In recent years there has been a loss of traditional conservation practices and other customs (food, dress, etc.), leading to erosion of the biocultural wealth of local communities. This has been mainly because of the expansion of the use of high-yielding species and varieties in commercial agriculture, climatic factors, pests and diseases, inappropriate agrarian policies and development activities and poverty, which increase the migration of indigenous youth (with their knowledge, experience and customs of traditional Andean agriculture).

In the communities included in the present initiative, it is the local farmers who have conserved the wide range of local varieties of Andean root crops on farm with exceptional success, mainly because they do not seek maximization of yield or income but rather, recognizing the need to spread risks, plant mixtures of different genotypes on small parcels of land, guaranteeing sustainable production every year.

The incentive provided by the development of agro-ecotourism could facilitate new mechanisms for promoting traditional conservation and sustainable use practices. During guided tours to the communities, tourists will see the remarkable morphological and agronomic variety of Andean plants and tubers in demonstration plots, a potato museum and restaurants with menus based on traditional Andean produce. Further attractions include displays of Andean camellids (Vicuña, Alpaca, Llamas and Guanacos). This proposed initiative intends to support a school education programme about Andean crops and culture and the participation of the young people in agro-ecotourism in order to reduce migration.

[†] Adapted from a case study presented by Ramiro Ortega, ANDES/IPBN.

Capacity building to disseminate sustainable methods for agricultural biodiversity conservation

- i. Enhancing farmer mobilization and participation, for example in the use of IPM schemes and conservation tillage (see Case study 4 from Viet Nam and Case study 1 from Brazil).

- ii. Developing farmer-to-farmer (and South-South) exchange and education and farmer field schools on alternatives that work; this may help to confront market or other pressures such as the use of inappropriate technologies.
- iii. Training of media and communication specialists to disseminate objective information to the public.

Capacity building for decision-making and planning and policy-making on agricultural biodiversity

- i. Integrating agricultural biodiversity initiatives into sectoral, cross-sectoral policies, plans, and programmes at national, regional and international levels.
- ii. Facilitating networking and exchange among lawyers and agriculture policy-makers on laws concerning IPRs and biosafety and their impacts on agricultural biodiversity.
- iii. Developing democratic participation and conflict resolution for agricultural biodiversity conservation and sustainable use (converging on common interests) but strengthening capacities to take controversial positions, if needed.
- iv. Developing policy-making capacities to link agriculture and environment interests (such as measures to internalize environmental costs).
- v. Sharing experiences about policies and incentives that work (e.g. India's tax on pesticides, European agri-environmental measures [2078/92], Ethiopia's laws on IPR).
- vi. Conducting policy reviews and analyses and the formulation, application and enforcement of coherent policies and laws to encompass agricultural biodiversity issues.
- vii. Conducting an institutional analysis with a view to identifying requirements for reform.

Case study 4

Improving agricultural biodiversity functions in intensive rice production through Integrated Pest Management and Aquatic Life Management, Viet Nam*

Farmers achieving higher production of rice and other crops by using Integrated Pest Management systems are also conserving and enhancing agricultural biodiversity. Conservation of agricultural biodiversity is an essential part of intensification to increase agricultural production levels. In rice monocultures wider agricultural biodiversity is important, for example, species that decompose organic matter contribute through an aquatic food chain to the build up of predator populations early in the season, even before planting. Ecologically, this renders the agro-ecosystem more resilient and therefore more productive. So long as pesticides are not used some 700 arthropod species can be found which keep these highly productive agro-ecosystems well balanced between pests, predators and parasitoids. Populations of fish, snails, frogs, aquatic insects and other species that constitute an important part of the diet of many rice-farming households are also enhanced in these systems. This is achieved through using Integrated Pest Management (IPM) techniques: the careful integration of a number of available pest control techniques which discourages the development of pest populations and keeps pesticide use and other interventions to levels that are economically justified and safe for human health and the environment, and enhances production of all functionally important species.

In hundreds of replicated field experiments it has been shown that there is a significant variation in biodiversity and population numbers between insecticide-sprayed and unsprayed fields within a distance as close as half a metre. This means that local variation dominates the context of decision making, so that human expertise is crucial and needs to be decentralized to the field and village level - and not kept in the research station nor in the extension system.

The approach used to reach and enhance local human expertise for IPM is through Farmer Field Schools (FFS) which build on local knowledge and expertise. About 25 farmers in FFS spend five to six hours together weekly; two hours are spent in the field observing the ecosystem and analysing its biodiversity. They collect arthropods in plastic bags and after the field work discuss what they have observed, prepare poster diagrams and present findings to their fellow farmers. They classify populations into functional groups depending on their trophic position in the agro-ecosystem. Farmers observe populations in the field but also test their trophic linkages by setting up "insect zoos". These answer their questions on "what eats what" and "how many are eaten", etc. Such experiments advance farmers' knowledge and lead to further experimentation with agricultural biodiversity, for example, the planting of different rice varieties that can make a big difference to disease resistance or other factors.

In the case of double cropped irrigated rice, in Viet Nam, with annual yields over 300% of the world average, farmers' advanced knowledge about rice field biodiversity has also led to experimentation with different management options. One example is growing a "crop" of fish together with rice in the same field, using the rice field to grow the crop of fish between two rice crops, or growing fish after rice instead of a second rice crop. Financial benefits per hectare surveyed in a sample of Farmers Field Schools in more than 1 300 villages averaged from 20 to 25% higher in IPM fields than in regular fields.

Better utilization of resources, healthy crops of rice and fish and increased income and food security reinforce farmers' acceptance of IPM and their rejection of pesticides. However, a prerequisite for these changes to take place is an enabling policy environment, for example, removing perverse pesticide subsidies or, as in India, putting a tax on pesticides. The increased skill and empowerment of farmers' groups through FFS also leads to stronger local accountability and the ability of farmers to determine local policies that increase benefits to production, income and the environment including agricultural biodiversity.

**Adapted from a case study presented by Peter Kenmore and Matthias Halwart, FAO.*

There are many good examples of best practices and of useful and appropriate technologies and approaches, including those for capacity building and awareness raising. The workshop concluded that it was necessary for these to be more widely available in order that the benefits could be more widely shared (see section 3.1.1). This will require worldwide efforts to incorporate such best practices and technologies into the training curricula and materials at all levels from farmer field schools to universities.

Mechanisms and linkages

In the light of the above and as emphasized repeatedly in the workshop, an approach is needed to improve the capacity of actors at all levels, including their capacity to work together. There are many very capable and knowledgeable people in all countries and at all levels; however, their capacities are often limited by resource constraints.

3.4 DEVELOPMENT OF POLICIES AND INSTRUMENTS

3.4.1 National, regional and international policy and regulatory frameworks

The decisions of the COP, FAO, CSD and other international and national bodies, through programmes of work at global, regional and local levels, provide many avenues for, and have committed governments to, the development of relevant policies and the need to ensure coherence between these.

Countries are already developing national biodiversity strategies and action plans, in accordance with relevant COP decisions. The opportunity exists to include agricultural biodiversity as an integral part of these through appropriate guidelines. Equally important, the conservation and sustainable use of agricultural biological diversity could be included in agriculture, rural development, trade, and other sectoral and cross-sectoral plans, and research and extension strategies at national, regional and international levels.

In regard to the reform of policies, particular opportunities to deal with these issues exist in Europe (EU) with the revision of the Common Agriculture Policy (CAP) and the development of Agenda 2000. Eastern European countries are seeking access to the EU and will need to harmonize their trade and environmental legislation, without further eroding their agricultural biodiversity resources.

In regard to the WTO negotiations, the participants recognized that agricultural biodiversity policies may be impacted by trade measures, including TRIPs, if these policies do not permit local determination of production methods and priorities nor recognize the importance of protecting agricultural biodiversity for sustainable food production, biological or life support systems and ecological and social services.

The current reviews and negotiations in the WTO require immediate action by all governments – the implications are significant. For low-income developing countries, extra time is being granted to implement WTO measures, which will give added opportunities to negotiate satisfactory arrangements internally and internationally in these countries. In light of this, there is a need to assess impacts of trade rules on environmental measures, including the conservation and sustainable use of agricultural biodiversity.

The workshop identified that in the ongoing round of negotiations on trade-related issues in the WTO context, competitive advantage will accrue to countries or regional blocs that negotiate effectively to reduce subsidies and gain support for the implementation of environmental measures. In this regard there is a need for countries within a region to collaborate in the identification and negotiation of such opportunities.

It was felt that appropriate actions need to be taken by competent bodies and authorities to account for biosafety considerations, with a view to avoiding and/or mitigating negative impacts on agricultural ecosystems resulting from pollution by chemicals, invasion by alien species and trends towards genetically uniform crops and breeds which threaten plant and animal diversity.

3.4.2 Coordination

Opportunities

The need for coherence at national level between relevant ministries and other sectoral bodies was thus raised as a key issue and as an opportunity to achieve integration of agricultural biodiversity concerns in overall biodiversity, environmental and agricultural policies, strategies and action plans. For example, it could be possible to ensure that ministries of agriculture are aware of and implementing relevant policy with respect to agricultural biodiversity that may hitherto have been the responsibility only of environment ministries. Similar coordination and cooperation between international organizations (similar to that achieved between FAO and CBD) should be encouraged.

Actions

Cross-sectoral coordination, joint planning initiatives and integrated approaches to the development of policy were seen as essential for progress in this area. The workshop noted the following areas for attention:

- national environmental action plans and conservation policies and plans;
- agricultural policies strategies and action plans including those pertaining to *in situ* and on-farm conservation;
- land-use policies;
- trade and marketing policies and regulations;
- wildlife and forest policies;
- plant variety protection laws;
- legal framework for pollution control, quarantine laws and safe minimum standards.

Mechanisms and linkages

There are many ecoregional and national differences in the impacts and importance of such measures. Thus, national and regional meetings could be organized to facilitate discussion and debate on these issues and to assist in the development of appropriate and coherent national legislation, policies and strategies.

Relevant governmental bodies and organizations should be encouraged to mainstream agricultural biodiversity issues into their national planning processes including the development, implementation and evaluation of agricultural and environmental policies, programmes and actions.

3.4.3 Negative market influences

Many issues were raised concerning the influence of the market on production and consumption patterns. The market is largely unregulated in terms of environmental and social impacts but highly influenced by international and national policies and trade rules. Market forces were seen to favour “new” varieties and use of agrochemicals, as well as larger economies of scale, the foci of agro-industry in lower-labour, industrial and monocultural production systems, leading to reductions in agricultural biodiversity. Other negative indirect effects were also identified, such as reduced recognition of local knowledge systems or of local diversity (e.g. local varieties and foods). This leads, in turn, to lower investments in local technological development by scientists and other innovators (including farmers). It also leads to lower income opportunities in agriculture in particular and in rural areas in general, and to the consequent loss of skilled people and new entrants into agriculture owing to outmigration from the area or the sector. The workshop contemplated whether there were any opportunities to bring about a change in paradigm to encourage agro-industries to strive for combined production and biodiversity goals and create alternative market structures to enable resource-poor producers to participate in these initiatives.

3.4.4 Incentive measures

Opportunities

The need for incentives for the conservation and sustainable use of agricultural biodiversity is based on the premise that those resources are a valuable asset for present and future generations and that their

preservation is essential for human economic development and is also important for social and cultural benefits. However, as many of the benefits of agricultural biodiversity conservation accrue to the public as a whole, and because of information, market and government failures, they are often utilized at levels that are not sustainable. Thus, incentive measures are required to internalize the costs of maintaining agricultural biodiversity in the activities that lead to this loss, and to provide the necessary information, support and encouragement for its sustainable use and/or conservation.

In this context it is recognized, for example by the OECD, that: *incentive measures should be designed in the context of sustaining ecosystems and with targeted resource management stakeholders in mind; and economic valuation of agricultural biodiversity and its products is an important tool for well-targeted and calibrated economic incentive measures*¹¹.

In order to identify appropriate incentive measures it is necessary to understand the relationship between market forces and agricultural biodiversity. This requires targeted research in different regions where different trade frameworks apply within different production economies.

Actions

The workshop discussed the use of different economic incentives:

- fees, charges and environmental taxes;
- market creation (see Case study 5) and assignment of well-defined property rights, in the context of full recognition of Farmers' Rights and appropriate land tenure regimes;
- reform or removal of perverse incentives;
- regulations and funds (standards, regulations and access restrictions; environmental funds and public financing);
- certification and eco-labelling (see Case study 6).

Case study 5

Rebuilding the endangered Aubrac cattle breed through niche marketing of cheese, France*

Local production and niche marketing of a named cheese has led to the revival of the Aubrac milking cow. Since the twelfth century the area has been used as summer pasture by cattle herds from farms up to 50 km away in the surrounding valleys. Most of the cows were draught animals of the local Aubrac breed, whose milk was used to make Laguiole, a local pressed fresh cheese. Since the 1920s the numbers being milked dropped for economic and social reasons as well as because of the reduction in requirements for draught animals. In 1960 the "Young Mountain" Cheese Cooperative was created to collect milk from the small producers and produce the now rare Laguiole cheese. However, the producers experimented first with Holsteins, which did not thrive on the mountain fodder and their milk was low in protein resulting in much rejected cheese, and then with multipurpose Simmentals (draught, meat and milk), which were more adapted to the mountains and in 1998 represented over 85% of the livestock in the area. However, this was still not completely satisfactory and in the early 1990s in order to re-establish a closer relation between the land and the cheese, the producers decided to assess the feasibility of re-introducing the local Aubrac race, famed for quality Laguiole cheese. With the help of the Laguiole Syndicate and the Livestock Institute, they are selecting and breeding improved dairy cows from some 15 mature Aubrac cows. The milk yields are rising dramatically and from an average of some 1 993 litres in 1956 it has reached 3 200 litres to date. The aim is to reach 4 000 litres per lactation through breed improvement over some 10 to 20 years.

**Adapted from a case study submitted by Guy Bouloc, Cooperative Jeune Montagne.*

¹¹ Based on Technical Brief No. 2 "Incentive Measures and the CBD" prepared for this workshop.

Case study 6

Increasing biodiversity conservation within coffee landscapes through eco-labelling, El Salvador*

Premium prices paid for biodiversity-friendly coffee is an incentive to maintain diverse shade-coffee landscapes – habitats for globally significant biodiversity.

Coffee is an important export crop in El Salvador. When introduced in the eighteenth century it was grown as a sun crop but then evolved within a shade-dominated farming system. Recently there has been a change back to (more intensive) “sun-coffee” systems owing, in part, to a USAID project, which provided subsidies to replace old coffee varieties with newer varieties that responded well to chemical fertilizers. The new system required removal of shade trees, in part to reduce the spread of coffee leaf rust. By the mid-1990s, of the estimated 2.8 million ha of coffee cultivated in the region, an estimated 1.1 million ha were considered to be “sun-coffee”.

This production system has yield advantages but has very negative impacts on biodiversity, mainly because it reduces the structural diversity of the system resulting in greatly reduced habitat, niche and species diversity. Several studies indicate the relatively high biodiversity in native and migratory bird species in traditional shade-coffee systems in Central America. Of 509 bird species in El Salvador, 310 are Neotropical residents, of which 128 are restricted to forest habitats and are mostly found in shade-coffee areas, and of these, two are threatened and 24 are vulnerable.

There was a consensus, achieved through collaborative project design, that the focus of biodiversity efforts needed included environmental restoration and promotion of biodiversity in existing productive landscapes, through the maintenance and enhancement of habitats within “shade-coffee” plantations. This would provide habitats for globally significant biodiversity through the establishment of a biological corridor composed of “shade-coffee” plantations. It required the promotion, certification and marketing abroad, especially in the United States, of biodiversity-friendly coffee production.

At the outset of the project, there was no developed market for existing “shade-coffee” and a lack of established product distribution systems. It was also necessary to demonstrate financial feasibility through pilot projects and to educate financing institutions about the value and opportunities for sales of environmentally-friendly coffee as well as its suitability for credit (coffee absorbs 75% of private sector credit for the agricultural sector). There was very little relevant environmental, social or economic data, no government research on “shade-coffee” agro-ecosystems and no training in sustainable, organic agriculture.

The project is showing that market forces, driven by consumer choice, can be harnessed to promote this ecologically-sustainable and bird-friendly form of management of coffee production and that the 5% premium for this new type of coffee (together with income from other non-coffee uses of traditional systems) is proving an incentive to keep lands in traditional, lower yielding but lower cost, production systems. The Global Environment Facility (GEF) is covering the cost of “risk” to market the new product, through a grant of some US\$3 million.

**Adapted from a case study presented by Random Dubois, FAO.*

The workshop stressed the importance of the contextual framework as an integral part of the incentive measures including information provision, scientific and technical capacity building, economic valuation, institution building and stakeholder involvement.

Mechanisms and linkages

There are significant initiatives being taken by various organizations, not only by governments and intergovernmental bodies, to promote incentive measures in various fields. The International Federation of Organic Agriculture Movements (IFOAM), among others, is pressing for satisfactory eco-labelling systems, supported by legislation, that will be recognized by trading partners.

3.4.5 The precautionary approach

The workshop highlighted the importance of applying the precautionary approach in agricultural development through the development and use of appropriate assessment and regulatory mechanisms. The aim is to ensure biosafety¹² in agriculture by taking necessary precautions to avoid negative impacts and to mitigate potential threats resulting from agricultural technologies on agro-ecosystems and their

¹² Biosafety is defined as the safe and environmentally sound use of all biological products and applications for human health, biodiversity and environmental sustainability in support of improved global food security (FAO/COAG/15/X0074).

surrounding ecosystems (those resulting from the use of agro-chemicals, the introduction and use of genetically modified organisms and/or alien invasive species).

3.4.6 Codes of conduct and practice

Some of the participants suggested that a new code of conduct for the conservation and sustainable use of agricultural biodiversity be developed which would not duplicate existing codes such as those for Responsible Fisheries, the Safe Collection of Plant Varieties, Biotechnology, etc. The aims of the new code would be to identify and synthesize the relevant regulatory frameworks already existing or planned, highlighting their relevance to ecosystem level, as well as the rights and obligations of different actors. It was felt that such a code of conduct could helpfully draw together the private sector, civil society and national, regional and international institutions in a synergistic relationship.

4 Conclusions and recommendations

On the basis of the work carried out by FAO and the CBD since COP III, the analysis of ongoing activities of international and national organizations, as well as the large amount of information considered by the workshop and the best available expertise brought to the workshop by the participants, showed that much relevant information and many activities, programmes, plans, strategies and policy instruments already exist to address the issues raised in the workshop.

4.1 PRIORITY ISSUES AND ACTIONS

The workshop concluded that the following four sets of actions for the conservation and sustainable use of all agricultural biodiversity, especially at agro-ecosystem levels, should be prioritized, bearing in mind that many of these actions have already been identified for particular sectors or types of agricultural biodiversity by other forums.

4.1.1 Information, assessment and indicators

Despite the work of many organizations on the development of assessment methodologies and indicators, the workshop identified deficiencies with respect to agricultural biodiversity at agro-ecosystem levels and prioritized the following needs:

- to facilitate the exchange of information between different actors and stakeholders;
- to identify agro-ecosystem-specific indicators and the use of these for assessment, monitoring and understanding the causes of changes in agricultural biodiversity;
- to focus on developing indicators particularly for changes at agro-ecosystem levels and for the economic forces that influence these changes;
- to link indicators and assessment with particular dimensions of agricultural biodiversity, such as for food security, biological support systems or agro-ecosystem functions.

4.1.2 Research and development

Although the research and development programmes of many international, national and local organizations already have focused on activities for the conservation and sustainable use of agricultural biodiversity, the workshop prioritized the need for:

- emphasizing greater coordination and information sharing between research and development programmes and better formal and informal sector linkages;
- strengthening national agricultural research systems on agricultural biodiversity related issues and for increasing research to demonstrate the value and costs and benefits of agricultural biodiversity conservation and sustainable use, building on proven local practices wherever possible;
- furthering farmer-driven participatory research and technology development processes through farmer field schools, recognition of local knowledge systems, etc., with full participation of local communities;
- emphasizing three main issues considered essential for research and development: ecosystem approaches and ecosystem functions; specific research on classes of species such as soil biota, pollinators and predators that are essential for productive soils and plants; and threats and positive incentives for agricultural biodiversity.

- developing a set of guiding principles for the identification, development, evaluation and reproduction of ecologically sound production systems and agricultural practices which promote the conservation and sustainable use of agricultural biodiversity in agro-ecosystems;
- promoting communications and facilitating the exchange of information on relevant scientific, research and practical information among different actors and stakeholders, including practitioners, producers and their organizations, and to relevant institutions and decision-makers, especially through improved South-South exchanges of electronic information.

4.1.3 Awareness raising and capacity building

Despite the interventions and actions of FAO, CBD and many expert institutions at all levels, and increased attention to biodiversity and sustainable use issues since UNCED, and bearing in mind the ecosystem approach adopted by the COP, the workshop prioritized actions for:

- *capacity building to improve knowledge and information on agricultural biodiversity* – which remains a key issue that hinders greater commitment and support – especially by raising awareness of the value and importance of agricultural biodiversity at the agro-ecosystem level;
- *capacity building to disseminate sustainable methods for agricultural biodiversity conservation* by demonstrating through case studies, training and briefing materials and public media as well as field demonstrations the importance and value of agricultural biodiversity in diverse agro-ecosystems and landscapes for all types of production systems;
- *capacity building for decision-making and planning and policy-making on agricultural biodiversity* by increasing communication, training and information campaigns in order to raise awareness and dialogue among policy-makers, politicians, professionals, producers, consumers, the public and students.

4.1.4 Development of policies and instruments

Even though there are a number of separate decisions, instruments, policies and programmes that address aspects of the conservation and sustainable use of agricultural biodiversity in agro-ecosystems, the workshop prioritized the need for:

- integrating agricultural biodiversity in national biodiversity programmes and action plans as well as in national environmental action plans and agricultural strategies and plans;
- developing coordination and policy coherence at international, national and regional level between relevant organizations, ministries and sectoral bodies at all levels;
- mitigating the influences of (and reforming where possible) the market, market forces and the existing economic framework which have major impacts on agricultural biodiversity, exacerbated by economic disincentives through, for example, inequitable land tenure and negative or perverse incentives;
- introducing incentive measures as important instruments to counter the above, including: fees, charges and environmental taxes; certification and eco-labelling; market creation and property rights; and regulations;
- developing and implementing a Code of Conduct on Agricultural Biodiversity, based on existing agreements, which would assist private sector, government and civil society organizations to identify their rights and obligations and inform their policy-makers and programme developers.

4.2 RECOMMENDATIONS

In the light of these priorities, and bearing in mind the opportunities, incentives and approaches discussed in the workshop, participants made the following three recommendations regarding:

- widening the understanding of agricultural biodiversity;
- increasing recognition of its essential contribution to all types of production systems at all levels; and
- improving integration and coordination of activities and processes.

4.2.1 Widening the understanding of agricultural biodiversity

A particular contribution by this workshop is the description of the scope of agricultural biodiversity in terms of a concept that could be applied at all scales, production systems and agro-ecosystems whereby *agricultural biodiversity encompasses the variety and variability of animals, plants and micro-organisms which are necessary to sustain key functions of the agro-ecosystem, its structures and processes for, and in support of, food production and food security.*

Within this concept of agricultural biodiversity, the workshop considered three dimensions of agricultural biodiversity that could be useful not only for increasing understanding but also as a structure for future programmes and plans:

- **Sustainable production** of food and other agricultural products emphasizing both strengthening sustainability in production systems at all levels of intensity and improving the conservation, sustainable use and enhancement of the diversity of all genetic resources for food and agriculture (plant and animal resources) in all types of production systems.
- **Biological or life support** to production emphasizing conservation, sustainable use and enhancement of the biological resources that support sustainable production systems particularly soil biota, especially those which develop soil fertility and improve plant production, pollinators and predators.
- **Ecological and social services** provided by agro-ecosystems emphasizing services such as landscape and wildlife protection, soil protection and health (fertility, structure and function), water cycle and water quality, air quality, CO₂ sequestration, etc.

The workshop discussed that this could help in developing criteria for priority setting; however, it was noted that any actions would need to be country-driven and locally validated (using case studies) and would need to be developed with the full participation of all actors including local producers and communities.

4.2.2. Increasing recognition of the essential contribution of agricultural biodiversity in all production systems

The workshop recommended that the maintenance, sustainable use and enhancement of all types and levels of agricultural biodiversity be encouraged in all types of production systems from diverse to specialized, small- to large-scale and intensive to extensive systems.

The workshop recognized that the interdependence of the plants and animals that are harvested with the agricultural biodiversity that provides biological support systems and ecological services is as relevant in intensive specialized agricultural systems as it is in more diverse production systems.

An obvious area on which to focus is the conservation and sustainable utilization of agricultural biodiversity in diverse, integrated production systems, especially in the Vavilov centres of diversity and within marginal lands. The workshop highlighted the importance of ensuring the implementation of integrated agro-ecosystem approaches to production work in these systems. It was agreed that the application of such holistic approaches can maximize sustainable production as well as conserving, sustainably using and enhancing agricultural biodiversity.

However, the workshop also recognized that in specialized, intensive production systems in all regions of the world, including industrialized countries, similar policies and actions are required, although the specific

interventions, actors and stakeholders will vary from one system to another according to the key threats and opportunities. In these intensive systems the importance of the biological systems that support production, such as increasing soil fertility, pollination and control of pests and diseases, and the ecological services provided by agricultural biodiversity, is often neglected with potential long-term negative impacts on production and the environment. This requires the development of new policies and approaches to the conservation and sustainable utilization of agricultural biodiversity within these intensive systems in order to sustain production as well as the removal or mitigation of perverse incentives and negative policies.

The workshop agreed on the vital importance of these approaches within specialized, intensive production systems and recognized the potential opportunities as well as the obstacles through the reform of agricultural support and trade measures, for example in the expanding European Union.

4.2.3. Improving integration and coordination of activities and processes for sustaining agricultural biodiversity, productivity and agro-ecosystem functions

The workshop underscored the importance of integration and coordination of activities and processes. Better cooperation and improved information flows among all actors, institutions, relevant departments and organizations was stressed as being essential for furthering work on: assessment and monitoring; research, development and extension; capacity building, education and awareness raising; and policy and development of legal frameworks. For example, existing inter-governmental commitments to implement decisions of CBD/COP and FAO include agricultural biodiversity measures, such as the Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (GPA) and the FAO Global Strategy for the Management of Farm Animal Genetic Resources. In this context, it was suggested that the development of national biodiversity action plans, national environmental action plans and agricultural strategies and plans, include action plans for the conservation and sustainable use of agricultural biodiversity at all levels, and that this would necessarily need to involve ministries of agriculture and environment, among others.

Coordination between all relevant focal points, departments and key organizations on these issues and actions was considered essential and generally in need of improvement. These include ministries, institutions, formal and informal sector organizations and the public and private sectors, at all levels. The proposed Code of Conduct on Agricultural Biodiversity was seen as a contribution to this.

All organizations in the field of sustainable development need to work further to integrate and mainstream agricultural biodiversity in their policies, programmes and activities in order to develop action plans on the conservation and sustainable utilization of agricultural biodiversity, especially at agro-ecosystem levels. The workshop particularly commended FAO's progress in this regard and noted the excellent working relationship between FAO and the CBD.

Opportunities, incentives and approaches
for the conservation and sustainable use
of agricultural biodiversity
in agro-ecosystems and production systems

FAO/CBD INTERNATIONAL TECHNICAL WORKSHOP

ANNEX I

Opportunities, Incentives and Approaches for the Conservation and Sustainable Use of Biological Diversity in Agricultural Ecosystems and Production Systems

2 - 4 December 1998, Rome, Italy

FINAL AGENDA

Date, Indicative Timing	Session, Activity / Who	Expected Outputs
	<p>OBJECTIVE OF MEETING</p> <p>Focusing on agro-ecosystems and production systems levels, the workshop will help to identify the main elements required to provide enabling environments and technical, policy, institutional and legal incentives, from global to local levels, for the conservation and sustainable use of agricultural biodiversity through:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Identification of possible mechanisms (approaches and incentives) for developing and promoting integrated, biodiversity-friendly efforts and actions at ecosystem level, in particular, those that optimize cooperation and synergies between agricultural and environmental sectors and subsectors and between the diverse actors; <input type="checkbox"/> Validation of the Assessment of ongoing activities and instruments on agricultural biological diversity using tools such as the ‘matrix’ and identification of, through this and other methods, criteria for setting priorities. <p><i>(NB Participants are present in their individual capacities as an expert peer group to provide advice to FAO/CBD)</i></p>	<p>There are four expected outcomes of the workshop:</p> <ul style="list-style-type: none"> <input type="checkbox"/> to stimulate work at country level and within institutions that will contribute to the conservation and sustainable use of agricultural biodiversity through the implementation of decisions III/11 and IV/6; <input type="checkbox"/> to provide advice to FAO and the CBD on the Assessment of ongoing activities and instruments on agricultural biological diversity, to enable SBSTTA¹³ to recommend priorities for the Convention’s work programme; <input type="checkbox"/> to assist FAO and the CBD to identify complementary and synergistic programmes in their joint work programme and through partnerships with other organizations that strengthen work on agricultural biodiversity and the ecosystem approach; <input type="checkbox"/> to contribute to the FAO-Netherlands Conference on the Multifunctional Character of Agriculture and Land that will feed into the FAO Conference and CSD-8.

¹³ Acronyms: SBSTTA - Subsidiary Body on Scientific, Technical and Technological Advice; COP - Conference of the Parties to the Convention on Biological Diversity (CBD); CSD - Commission on Sustainable Development; CGRFA - Commission on Genetic Resources for Food and Agriculture; GS - Global System on the conservation and sustainable utilization of plant genetic resources for food and agriculture.

Date, Indicative Timing	Session, Activity / Who	Expected Outputs
<p>Wednesday, 2 December</p> <p>SESSION 1 Chair: Mr J. Pieters (GON)¹⁴ 14:00 – 15:10 <i>Philippine Room Building C 277/281</i></p> <p>Wednesday, 2 December</p>	<p>PURPOSE OF DAY – generating a common understanding of the key areas of attention and/or issues that address the conservation and sustainable use of different components of agricultural biological diversity and their inter-relationships and linkages at ecosystem level with regard to sustainable agriculture and food and livelihood security.</p> <p>OPENING OF WORKSHOP Welcome to all participants by Chair, L. Fresco FAO (5 mins) and H. Zedan CBD (5 mins)</p> <p>CONTEXT – Policy level activities on agricultural biodiversity Introduction to the relevant policy level activities, among others the CBD, CSD and CGRFA/GS processes. Key issues and activities, inter-relationships and linkages concerning the conservation and sustainable use of agricultural biodiversity within agroecosystems, meanings of terms such as:</p> <p>Multifunctional character of agriculture, agricultural biodiversity, agro-ecosystem, & L. Fresco, FAO (30 mins)</p> <p>Contributions of the workshop to the SBSTTA and COP process, with reference to the SBSTTA process, inter-sessional meeting and COP V. S. Bunning, CBD (20 mins)</p> <p>Workshop methodology and logistics – introduction to workshop process and to the following session regarding the review of the analytical matrix and definitions P. Mulvany, Facilitator (10 mins)</p> <p>Questions and clarification (5 mins)</p>	<ol style="list-style-type: none"> 1. Participants to achieve enhanced understanding of the key areas of attention in regard to agricultural biodiversity at ecosystem and production system level and a common understanding of the terms used during the workshop and of the analytical process being used by CBD-FAO for the ongoing assessment. 2. Knowledge of ongoing agricultural biodiversity activities at policy level (CBD and CSD) and capacity to enhance implementation of the multi-year programme of work on agricultural biodiversity at country level, directly through participants’ work and through their influencing relevant institutions and processes.
15:30 – 15:40	<i>Coffee</i>	
<p>SESSION 2 Chair: Mr J.</p>	<p>□ INTRODUCTORY EXERCISE participants to introduce themselves and give their judgement of the two most important issues that constrain or facilitate the</p>	

¹⁴ GON - The Government of the Netherlands.

Date, Indicative Timing	Session, Activity / Who	Expected Outputs
Pieters (GON) 15:40 – 18:00 17:40	conservation and sustainable use of agricultural biodiversity within agroecosystems and production systems (30 mins) <input type="checkbox"/> CASE STUDY: Potential of Conservation Tillage for Sustainable Agriculture José Benites and Theodor Friedrich, FAO (40 mins) <input type="checkbox"/> GROUP DISCUSSIONS (6 groups) Review of analytical matrix for the Assessment, checking common understanding, start problem analysis (40 mins) <i>A1-Pakistan(A372); A2-Cuba(B224); B1-Canada(A356); B2-Mexico(D211); C1-4; C2-Philippine)</i> <input type="checkbox"/> PLENARY Questions, brief discussion, logistical arrangements (15 mins) SUMMING UP Review of afternoon and preparations for Thursday P. Mulvany (5 mins)	
18:00	<i>Cocktails in Indonesia Room followed by Supper at Ristorante Taverna Cestia, Via Piramide Cestia 65</i>	

Date, Indicative Timing	Session, Activity / Who	Expected Outputs
<p>Thursday, 3 December</p>	<p>PURPOSE OF DAY – Identification of key issues and ways and means to promote the conservation and sustainable use of agricultural biodiversity, in particular those addressing ecosystem level, through assessing constraints and obstacles and lessons learnt, in terms of best practices and technologies, considering:</p> <p>(a) a number of diverse agricultural production systems,</p> <p>(b) the multifunctional roles of agriculture and land use, and</p> <p>(c) the application of the ecosystem approach to the conservation and sustainable use of agricultural biological diversity, taking into account the concepts and principles being developed under the CBD.</p>	<p>Enhanced and shared information and awareness of participants regarding:</p> <ol style="list-style-type: none"> 1. Diverse agricultural production systems, the multi-functional roles of agriculture and land use, and the application of the ecosystem approach to agricultural biological diversity; 2. Promising approaches, incentive measures, methodologies, best practices and technologies; 3. Ways and means for: collecting data, information and research; developing indicators, monitoring and assessment; capacity building and training; education and awareness; developing networks and partnerships 4. Ways and means to develop and implement appropriate national strategies, programmes and action plans, legislation, codes of conduct and policy development. 5. Ways and means to better integrate suggestions into international and regional processes and actions.
<p>Thursday, 3 December SESSION 3 Chair: Mr M. Duwayri (FAO) 08:45 – 10:20 <i>Lebanon Room Building D 209</i></p>	<p>INTRODUCTION by Chair (5 mins)</p> <p>PRESENTATIONS of Case Studies: Integrating Agricultural Biodiversity Concerns into Mainstream Policies in Eastern Africa Lori Ann Thrupp, WRI; Agro-ecotourism Ramiro Ortega, Asociación Andes, Peru; Integrated Pest Management Peter Kenmore and Matthias Halwart, FAO (c. 20 mins each)</p> <p>Questions for clarification</p> <p>PREPARATION FOR WORKING GROUP SESSION (5 mins)</p>	

Date, Indicative Timing	Session, Activity / Who	Expected Outputs
10:20 – 11:45	<p>WORKING GROUPS - 6 Groups (All groups using Matrix as framework for discussions, bearing in mind technical, social, economic and institutional issues) (<i>A1-Pakistan(A372); A2-Cuba(B224); B1-Canada(A356); B2-Mexico(D211); C1-4; C2-Lebanon</i>)</p> <p>A: Ecosystem and landscape management and integrated natural resources management including wildlife, watersheds, etc.</p> <p>A1: INFORMATION AND UNDERSTANDING– Data/Information Systems, Identification and Characterization, Indicator Development, Monitoring and Assessment (Rows 1,2,3 of matrix)</p> <p>A2: TOOLS AND METHODS – Research; Approaches; Best Practices and Technologies (Rows 4,5 of matrix)</p> <p>B: Promoting integrated/diverse farming systems and technologies</p> <p>B1: INFORMATION AND UNDERSTANDING – Data/Information Systems, Identification and Characterization, Indicator Development, Monitoring and Assessment (Rows 1,2,3)</p> <p>B2: TOOLS AND METHODS – Research; Approaches; Best Practices and Technologies (Rows 4,5 of matrix)</p> <p>C: Enhancing biodiversity considerations in intensive, specialized farming systems and technologies</p> <p>C1: INFORMATION AND UNDERSTANDING – Data/Information Systems, Identification and Characterization, Indicator Development, Monitoring and Assessment (Rows 1,2,3 of matrix)</p> <p>C2: TOOLS AND METHODS – Research; Approaches; Best Practices and Technologies (Rows 4,5 of matrix)</p>	:
12:00 – 12:45	<p>PRESENTATIONS of Case Studies: Promotion of Biodiversity Conservation within Coffee Landscapes Random Dubois, FAO; Zero Tillage Farming Helvecio Saturnino, Brazil (<i>c. 20 mins each</i>)</p>	
12:45 – 13:15	<p>PLENARY - Brief feedback – on flipcharts (<i>30 mins</i>)</p>	
13:15	<p><i>Light sandwich lunch</i></p>	

Date, Indicative Timing	Session, Activity / Who	Expected Outputs
14:15 – 16:00	<p>WORKING GROUPS - 6 Groups to take into account all ‘Cells of the Matrix’, with an emphasis on sub-divisions of Column A</p> <p>A: Ecosystem and landscape management and integrated natural resources management including wildlife, watersheds, etc.</p> <p>A1: CAPACITIES: – Capacity Building/Training, Education and Awareness (Rows 6,7 of matrix)</p> <p>A2: INSTITUTIONS, LINKAGES & POLICY – Networks and Partnerships; Support to National Programmes, Strategies and Action Plans, Policies and Legislation including codes of conduct (Rows 8,9, 10 of matrix)</p> <p>B: Promoting integrated/diverse farming systems and technologies</p> <p>B1: CAPACITIES – Capacity Building/Training, Education and Awareness (Rows 6,7 of matrix)</p> <p>B2: INSTITUTIONS, LINKAGES & POLICY – Networks and Partnerships; Support to National Programmes, Strategies and Action Plans, Policies and Legislation including codes of conduct (Rows 8,9, 10 of matrix)</p> <p>C: Enhancing biodiversity considerations in intensive, specialised farming systems and technologies</p> <p>C1: CAPACITIES – Capacity Building/Training, Education and Awareness (Rows 6,7 of matrix)</p> <p>C2: INSTITUTIONS, LINKAGES & POLICY – Networks and Partnerships; Support to National Programmes, Strategies and Action Plans, Policies and Legislation including codes of conduct (Rows 8,9, 10 of matrix)</p>	
Thursday, 3 December 16:00 – 18:00	<p>PLENARY (<i>Coffee available</i>)</p> <p>Presentation of output from Working Groups (<i>6 x 10 mins</i>)</p> <p>Plenary discussion of key points raised (<i>15 mins</i>)</p>	

Date, Indicative Timing	Session, Activity / Who	Expected Outputs
17:15 – 18:00	<p>WORKING GROUPS – 5 NEW Groups, working Thursday p.m. <i>(D-Pakistan(A372); E-Cuba(B224); F-Canada(A356); G-Mexico(D211); H-Lebanon (D209))</i></p> <p>Objective of each group is to use the outcome from the earlier working groups, the case studies and their own knowledge to identify priorities, gaps and ways of taking these forward, in order to come up with clear results. Each Working Group should, in the following order:</p> <ol style="list-style-type: none"> 1. Prioritize issues, incentive measures and actions 2. Identify mechanisms for implementation of priority actions 3. Suggest how to integrate these priorities into existing plans or new programmes <p>In considering these topics, Groups will be asked to focus on different sets of ‘Rows of the Matrix’</p> <p>D. INFORMATION AND UNDERSTANDING – Data/ Information Systems, Identification and Characterisation, Indicator Development, Monitoring and Assessment (Rows 1,2,3 of matrix)</p> <p>E. TOOLS AND METHODS – Identification and development of: Methods and Approaches; Best Practices and Technologies (Rows 4,5 of matrix)</p> <p>F. CAPACITIES – Capacity Building/Training, Education and Awareness (Rows 6,7 of matrix)</p> <p>G. INSTITUTIONS & LINKAGES Networks and Partnerships; Support to National Programmes, Strategies and Action Plans (Rows 8,9 of matrix)</p> <p>H. POLICY - Policies and legislation, codes of conduct and international level processes &c (Row 10 of matrix)</p> <p>Initial Feedback written on flipcharts, possibly in the form of tables, to be placed in main Plenary Room (Lebanon Room D 209) at the end of the day</p>	
18:30	<i>Cocktails at the invitation of GON in Ristorante Orazio, Via di Porta Latina 5</i>	

Date, Indicative Timing	Session, Activity / Who	Expected Outputs
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Date, Indicative Timing	Session, Activity / Who	Expected Outputs
Friday, 4 December	<p>PURPOSE OF DAY – to agree on priorities and actions including possible mechanisms for implementation (approaches and incentives)</p> <ol style="list-style-type: none"> 1. Consolidation of results 2. Agreement on priority issues and areas of attention, aims and objectives and possible incentives and approaches and ways and means to address them 3. Suggestions on ways and means to integrate the suggestions <ol style="list-style-type: none"> (a) into national programmes , strategies and action plans, (b) into policies and legislation, codes of conduct etc., and (c) into international and regional programmes (e.g. GPA, GS, etc.). 	

Date, Indicative Timing	Session, Activity / Who	Expected Outputs
<p>SESSION 4 Chair: Mr P. Vermeij (GON) 08:45 – 11:15 <i>Lebanon Room Building D 209</i></p>	<p>INTRODUCTION by Chair (5 mins) RESUME of progress so far (Facilitator) (10 mins) PRESENTATION of operation of Global Environment Facility E Fuentes, UNDP</p> <p>NEW WORKING GROUPS – 4 Groups Each group to prepare relevant conclusions on:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Prioritization of issues <input type="checkbox"/> Identification of mechanisms for implementation of priority actions, including incentives and approaches <input type="checkbox"/> Suggestions for integration into existing plans or new programmes <input type="checkbox"/> Identification of possible means of support for new activities or programmes <p>Working Groups <i>(I - Lebanon (D209); II -Canada(A356); III -Pakistan(A372); IV - Mexico(D211))</i></p> <p>I. POLICY – National Strategies, Programmes and Action Plans including Agriculture, Environment, Trade, Aid; Sectoral policies; Incentives and disincentives; FAO, CBD, CSD processes</p> <p>II. RESEARCH AND DEVELOPMENT – Generation of New Knowledge and Capacities: Influence research agendas; Farmer Research - building on local knowledge; Consumer preference; Transformation from commodity driven approach to ecosystem driven approaches</p> <p>III. BEST PRACTICES AND TECHNOLOGIES – Building on existing Knowledge and Capacities: Recognition of good practice and technologies; Empowerment of resource users, communities; Approaches to support good practice and technologies; Address driving forces in different ecoregions and agro-ecosystems</p> <p>IV. INFORMATION, IDENTIFICATION, MONITORING AND ASSESSMENT – Functional ecosystem approach; Indicators and Criteria for assessment; Process for Monitoring and Assessment; Relationships between genetic diversity and ecosystem function; How to build on sectoral assessments in a holistic agricultural biodiversity assessment</p>	<ol style="list-style-type: none"> 1) Agreement on priority issues and areas of attention, aims and objectives of possible programmes and possible incentives and approaches and ways and means to address the identified priorities 2) Suggestions on ways and means to integrate the above: <ol style="list-style-type: none"> a) into national programmes , strategies and action plans, b) into policies and legislation, codes of conduct etc., and c) into international and regional programmes 1) Identification of possible opportunities for further scientific and technical cooperation. <ul style="list-style-type: none"> <input type="checkbox"/> <i>All groups are asked to consider how to provide advice on the Ongoing Review and Analysis of ongoing activities and existing instruments (FAO-CBD process):</i> <ol style="list-style-type: none"> 1) <i>recommendations of the workshop in each area covered by the groups;</i> 2) <i>scientific and technical/expert input;</i> 3) <i>organizational support</i> <input type="checkbox"/> <i>All groups to consider in their work where they can flag specific ecorgional approaches, niches, etc.)</i> <input type="checkbox"/> <i>All groups to consider Institutions and Linkages and Partnerships</i>

Date, Indicative Timing	Session, Activity / Who	Expected Outputs
Friday, 4 December 12:00 – 13:00	PLENARY Presentation and consolidation of results Agreement of priorities and actions &c	
13:00	<i>Light Sandwich Lunch available</i>	
SESSION 5 Chair: Mr. P. Vermeij (GON) 15:00 – 16:30	FINAL PLENARY <ul style="list-style-type: none"> <input type="checkbox"/> Presentation of outcomes <input type="checkbox"/> Discussion <input type="checkbox"/> Agreement on recommendations <input type="checkbox"/> Follow-up process <input type="checkbox"/> Closing remarks <ul style="list-style-type: none"> <input type="checkbox"/> Mr. J. De Leeuw (The Government of The Netherlands) <input type="checkbox"/> Ms S. Bunning (CBD-Secretariat) <input type="checkbox"/> Mr. H. Carsalade (FAO) 	<ol style="list-style-type: none"> 1. Provisional recommendations endorsed by all participants 2. Commitment to follow-up agreed

LIST OF PARTICIPANTS**ANNEX II**

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Sustainable Use
of Biological Diversity in Agricultural Ecosystems and Production Systems”
2-4 December 1998, FAO, Rome**

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MATRIX for Analysis and Synthesis of Relevant Ongoing Activities and Instruments

ANNEX III

Conservation and Sustainable Use of Agricultural Biological Diversity and the Equitable Sharing of Benefits derived from Genetic Resources
Table: Activities and Instruments, including Expected Outcomes, Classified by Type of Action or Instrument (row) and by Thematic Area (column)

		Institution/Organization/Technical Dept:			Function of Reporting Officer:				Date:
		A	B	C	D	E	F	G	H
	<i>Indicate for each entry: ONGOING (O) or PLANNED (P) Activity</i>	Ecosystem and Production¹⁵ System Levels (including Agroforestry Systems and Wild-life Habitats and Border Habitats)	Air and Climatic Factors, Land and Water Resources (including Land Use Pressures)	Plant Genetic Resources including Agroforestry Species, Wild Species and Wild Sources of Food¹⁶ (aquatic/terrestrial)	Animal Genetic Resources including Wild Species, and Wild Sources of Food (aquatic/terrestrial)	Microbial Genetic Resources (aquatic/terrestrial)	Farm Inputs and Biocontrol Organisms	Traditional Knowledge (including knowledge systems of indigenous and local communities)	Marketing Conditions and Forces including Trade Issues
1.	Data/Information Systems								
2.	Identification and Characterization								
3.	Indicator Development, Monitoring and Assessment								
4.	Identification and Development of Methods and Approaches (Survey and Research)								
5.	Identification and Development of Best Practices &								

¹⁵ Column A to be subdivided as necessary into ecosystems level and production system level

¹⁶ Columns to be subdivided as appropriate e.g. plants and trees: cereal/leguminous/pasture/industrial/horticultural crops... trees... agroforestry species, etc.

Conservation and Sustainable Use of Agricultural Biological Diversity and the Equitable Sharing of Benefits derived from Genetic Resources
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		Institution/Organization/Technical Dept:			Function of Reporting Officer:				Date:
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	<i>Indicate for each entry: ONGOING (O) or PLANNED (P) Activity</i>	Ecosystem and Production¹⁵ System Levels (including Agroforestry Systems and Wild-life Habitats and Border Habitats)	Air and Climatic Factors, Land and Water Resources (including Land Use Pressures)	Plant Genetic Resources including Agroforestry Species, Wild Species and Wild Sources of Food¹⁶ (aquatic/terrestrial)	Animal Genetic Resources including Wild Species, and Wild Sources of Food (aquatic/terrestrial)	Microbial Genetic Resources (aquatic/terrestrial)	Farm Inputs and Biocontrol Organisms	Traditional Knowledge (including know-ledge systems of indigenous and local communities)	Marketing Conditions and Forces including Trade Issues
	Technologies (Survey and Research)								
6.	Capacity building/Training								
7.	Education /Awareness								
8.	Networks and Partnerships (farmers; communities; private & public sectors)								
9.	Support to National Strategies, Programmes, Action Plans								
10.	Legislation, Codes of Conduct and Policy Development								

**Priority Issues and Activities Identified for the Conservation and Sustainable Use
of Agricultural Biodiversity in Agroecosystems and Production Systems**

MATRIX ROW	PRIORITIZED ISSUES/ACTIVITIES
1. Data/ Information Systems	<ul style="list-style-type: none"> <input type="checkbox"/> Inventory of databases – characterizing these for agricultural biodiversity and ensuring linkages by function – on e.g. Agricultural practices and local knowledge systems; Land use maps; Types of farming systems; Agricultural Biodiversity status (in order to monitor change, systems under threat, disaster preparedness, etc.).
2. Identification and Character- ization	<ul style="list-style-type: none"> <input type="checkbox"/> Research and identification of key environmental functions and processes for each agroecosystem. <input type="checkbox"/> Identifying key species in specific habitats
3. Indicator Development, Monitoring and Assessment	<ul style="list-style-type: none"> <input type="checkbox"/> Identifying key biodiversity/environmental indicators for specific environmental functions and for functional agricultural biodiversity <input type="checkbox"/> Long-term monitoring of agricultural impacts, especially for environments under greatest threat, using indicators identified <input type="checkbox"/> Monitoring the influence of local systems and local technology/knowledge and of consumer preferences on efforts to enhance agricultural biodiversity <input type="checkbox"/> Indicators to include critical economic, ecological, and social (including demographic) factors; focus on environmental functions of agroecosystems that enable positive impacts; focus on critical factors that reveal interactions between soil, plant insect, trees, etc., biodiversity functions and food production; consider scalability <input type="checkbox"/> Development of effective processes for monitoring and assessment: fully involving local people/farmers (using participatory methods); including multiple levels of analysis (regional to local, remote sensing to farmer scouting) and key indicators of sustainability; undertake comparative and intersectoral analyses (both short-term and long-term assessments) of different interventions to understand impacts <input type="checkbox"/> Environmental impact assessment (EIA) and environmental accounting for agricultural practices both at farm level and landscape level
4. Identification and Develop- ment of Methods and Approaches	<ul style="list-style-type: none"> <input type="checkbox"/> Need for a broad global study on the role of functional agricultural biodiversity in intensive farming systems, based on concrete pilot projects in various farming systems <input type="checkbox"/> Understanding and developing methods for using functional agricultural biodiversity <input type="checkbox"/> Review and develop current research programmes to identify knowledge gaps (e.g. knowledge of local farming systems, forces behind changes, etc.) <input type="checkbox"/> Identify opportunities for exploiting market forces
5. Identification and Develop- ment of Best Practices &	<ul style="list-style-type: none"> <input type="checkbox"/> Increasing the focus on relationship between soil fertility and agricultural biodiversity, especially of soil biota <input type="checkbox"/> Understanding the relationship between agricultural biodiversity and integrated farming systems <input type="checkbox"/> Developing the role of local technologies in integrated pest management

MATRIX ROW	PRIORITIZED ISSUES/ACTIVITIES
Technologies	<p>systems and the protection of predators, soil biota and other species e.g. fish</p> <ul style="list-style-type: none"> <input type="checkbox"/> Develop new technologies e.g. GIS/RS/farmer problems
6. Capacity building/ Training	<ul style="list-style-type: none"> <input type="checkbox"/> Training in using GIS: Remote Sensing and analysis of the information for wider dissemination <input type="checkbox"/> Participatory “hands-on” and integrated training and non-formal multidisciplinary education processes <input type="checkbox"/> Farmer-to-farmer (and south-south) exchange of information on alternatives that work <input type="checkbox"/> Farmer field schools for developing local capacities of farmers as a means of building on traditional local knowledge about agricultural biodiversity <input type="checkbox"/> Participatory breeding <input type="checkbox"/> Training of trainers and other relevant stakeholders, including managers
7. Education/ Awareness	<ul style="list-style-type: none"> <input type="checkbox"/> Information has to be made accessible to all user groups including the wider public, in local languages <input type="checkbox"/> Need to demonstrate and prove importance/value of agricultural biodiversity, agroecosystems/landscapes and the environmental aspects of agriculture <input type="checkbox"/> Extension service to promote agricultural biodiversity-friendly techniques <input type="checkbox"/> Communication, training and information campaigns to raise awareness among policy-makers, politicians, professionals, producers, opinion formers, the public (consumers) and school children, of the benefits of conserving and sustainably using agricultural biodiversity and agroecosystems, and the threats to these
8. Networks and Partnerships (farmers; communities; private & public sectors)	<ul style="list-style-type: none"> <input type="checkbox"/> Networking and coordination among key stakeholders at all levels <input type="checkbox"/> Integration of stakeholders to share knowledge of information on agricultural biodiversity <input type="checkbox"/> Networking, coordination and information exchange among lawyers and agriculture/environmental policy-makers on regulations and laws concerning IPRs, Biosafety, Farmers’ Rights etc.; Sharing experiences about policies and incentives that work <input type="checkbox"/> Empowerment of farmers, <i>inter alia</i> through local fora based on a collegial relationship between farmers, scientists and extension workers <input type="checkbox"/> Community-sponsored production (consumers – producers cooperation) and local seed security through e.g. exchange of genetic material
9. Support to National Strategies, Programmes, Action Plans	<ul style="list-style-type: none"> <input type="checkbox"/> Integration of agricultural and environmental policies and linking agricultural biodiversity with biodiversity planning <input type="checkbox"/> Involve local people in policy design <input type="checkbox"/> Develop policy-making capacities to link agriculture and environment interests (such as measures to internalise environmental costs)
10. Legislation, Codes of Conduct and Policy Development	<ul style="list-style-type: none"> <input type="checkbox"/> Integrate agricultural biodiversity issues within the framework of agriculture planning to assist in creation of appropriate policies/markets/strategies; NB Land tenure, Privatisation <input type="checkbox"/> Full cost pricing through internalization of positive/negative externalities in investments, income, prices <input type="checkbox"/> Positive and negative incentives through credit, taxation and subsidy <input type="checkbox"/> Certification/eco-labelling of agricultural products produced in agricultural

MATRIX ROW	PRIORITIZED ISSUES/ACTIVITIES
	biodiversity-friendly systems <input type="checkbox"/> Impacts of trade rules on agricultural biodiversity and environment <input type="checkbox"/> IPRs, Farmers' Rights, Biosafety, Biotechnology/Genetically Modified Organisms etc. <input type="checkbox"/> Development of existing and new Codes of Conduct <input type="checkbox"/> Development of Gender sensitive policies

**Analysis of Required Actions for Enhancing Agricultural Biodiversity
and Production in Intensive Production Systems in Selected Agro-ecosystems**

Humid Tropical Irrigated Production Systems (Rice)	
Practical actions	<input type="checkbox"/> Field schools for improvement of farmers' skills <input type="checkbox"/> Participatory plant breeding
Policies	<input type="checkbox"/> National strategy development <input type="checkbox"/> Taxes on use of pesticides <input type="checkbox"/> IPM Facility <input type="checkbox"/> Post-disaster rehabilitation
Research	<input type="checkbox"/> More focus on relationship between soil fertility and agrobiodiversity <input type="checkbox"/> Relationship between agrobiodiversity and integrated rice – fish aquaculture production/ soil-plant nutrition <input type="checkbox"/> Role of local breeding for existence in integrated pest management
Participants/links	<input type="checkbox"/> FAO, IRRI, SEARICE, WARDA, CARE and other NGOs, GEF
Intensive Agroforestry Systems (Coffee and Multi-purpose use)	
Practical actions	<input type="checkbox"/> Draw upon the El Salvador 'shade-coffee' case study <input type="checkbox"/> Inventory and policy development in Ethiopia <input type="checkbox"/> Promotion of ecological coffee, <i>inter alia</i> to be presented at EXPO 2000 in Hanover, Germany
Policies	<input type="checkbox"/> Implementation of decisions by the International Coffee Board <input type="checkbox"/> Eco-labelling and Fair Trade – labelling (in voluntary systems)
Research	<input type="checkbox"/> 'Sun-coffee' vs 'shade-coffee' in the El Salvador case study <input type="checkbox"/> Role of ICIPE and ICRAF with respect to understanding (functional) agricultural biodiversity in intensive agroforestry cash-cropping systems <input type="checkbox"/> Influence of consumers on efforts to enhance agricultural biodiversity. <input type="checkbox"/> Genetic variability and sustainable production
Participants/links	<input type="checkbox"/> National governments, the international coffee board, local NGOs, national and international research institutions, GEF, private sector
Intensive Mountain Production Systems (Potatoes)	
Practical actions	<input type="checkbox"/> Maintain local diversity, focusing on on-farm conservation <input type="checkbox"/> Use of true potato seed instead of mixed clones <input type="checkbox"/> Six countries programme of IFAD, CIP, IPM/FAO.
Policies	<input type="checkbox"/> Promotion of exchange of genetic material between local producers <input type="checkbox"/> Promotion of watershed management <input type="checkbox"/> <i>In situ/on-farm vs ex situ</i> conservation
Research	<input type="checkbox"/> Varietal replacement of traditional varieties by introduced ones on agrobiodiversity (gene flows) <input type="checkbox"/> Changes in production systems on agricultural biodiversity. <input type="checkbox"/> Maintain local diversity
Participants/links	<input type="checkbox"/> National governments, CIP, NGOs, national research centres, GEF

Industrial Agricultural Production Systems (Europe)	
Western Europe Practical Actions	<input type="checkbox"/> EU regulation on agri-environmental measures (2078/92) <input type="checkbox"/> Promotion of local food production and Heritage Seeds <input type="checkbox"/> Promotion of integrated rural development <input type="checkbox"/> Community-sponsored production (consumers – producers cooperation) <input type="checkbox"/> Eco-labelling and certification of ecological food production <input type="checkbox"/> Biotopes/corridors (e.g. Sweden) <input type="checkbox"/> Eco-Agri-Tourism
Policies	<input type="checkbox"/> EU regulations <input type="checkbox"/> National policies for the promotion of ecological production <input type="checkbox"/> Programmes to promote conservation of agricultural biodiversity and cultural heritage values in the agricultural landscape <input type="checkbox"/> Promotion of the protection of environmentally sensitive areas <input type="checkbox"/> Secure WTO-legal environmental measures in next negotiating round
Research	<input type="checkbox"/> Multifunctional land use, integrating agricultural landscapes <input type="checkbox"/> Agricultural biodiversity and soil fertility <input type="checkbox"/> Agricultural biodiversity and pest management
Participants/links	<input type="checkbox"/> EC/EU, Private Sector / Retailers, NGOs
Eastern Europe Additional Practical Actions and Policy issues of special relevance	<input type="checkbox"/> Create niches for ecological production in the process of preparation for membership in the EU without the benefit of agricultural subsidies <input type="checkbox"/> Protect small, diverse farms, local agricultural biodiversity and local animal breeds <input type="checkbox"/> Need for improved varieties and techniques suited to local circumstances <input type="checkbox"/> Policies that do not mimic the Western European production paradigm that is reducing diversity