



SUMMARY OF THE INTERNATIONAL SYMPOSIUM ON MANAGING BIODIVERSITY IN AGRICULTURAL ECOSYSTEMS 8-10 NOVEMBER 2001

The International Symposium on Managing Biodiversity in Agricultural Ecosystems convened from 8-10 November 2001 in the International Civil Aviation Organization (ICAO) Building in Montreal, Canada. The Symposium was organized by the United Nations University (UNU), the Secretariat of the Convention on Biological Diversity (CBD) and the International Plant Genetic Resources Institute (IPGRI). This three-day Symposium brought together approximately 140 participants from the academic, government, research and nonprofit worlds to share experiences, case studies, initiatives and ideas on the management of biodiversity in agro-ecosystems.

The Symposium was organized on a thematic basis covering the topics of: crop and livestock genetic resources; associated biodiversity and agro-ecosystem services; and landscape, scale and change. Each day addressed a different theme, with presenters offering their research in sessions focused on specific aspects within the broader topic. Poster displays outside the meeting halls further explored the thematic areas. The Symposium's objectives were to: advance understanding of the complex process and mechanisms for on-farm management of biodiversity and their relation with farmers' livelihoods; compare and exchange experiences in encouraging profitable management practices and systems of biodiversity on farm; identify lessons learned for policy and capacity building; and contribute to, and promote, the implementation of the CBD Programme of Work on Agricultural Biodiversity.

A BRIEF HISTORY OF EFFORTS TO MANAGE BIODIVERSITY IN AGRICULTURAL ECOSYSTEMS

Agricultural biodiversity includes all components of biological diversity of relevance to food and agriculture, including genetic crop and livestock resources. Agricultural biodiversity provides food, income and materials for clothing, shelter and medicine. It also performs ecological services essential to human survival, such as nutrient cycling, pest and disease regulation and pollination.

Much has been written about the impacts on biodiversity from land use practices, but only limited work has been done on how farmers, the "custodians of biodiversity," manage their resources to sustain and enhance them. Through innovation and experiment, farmers have accumulated rich knowledge of managed biodiversity. Collaborative efforts between scientists and small farmers have been

initiated to tap farmers' knowledge and skills for the conservation and sustainable use of biodiversity in agro-ecosystems. Management of agricultural biodiversity has temporal and spatial attributes as well as socio-economic implications. The Symposium was intended to share the experiences and ideas of the international community working on agricultural biodiversity with the hope that the collected knowledge would be useful for international and national biodiversity programmes and policy.

On the international level, the International Treaty on Plant Genetic Resources for Food and Agriculture was adopted at the 6th Extraordinary Session of the Commission on Genetic Resources for Food and Agriculture on 3 November 2001. The International Treaty establishes a Multilateral System for facilitated access to a specified list of plant genetic resources for food and agriculture. Its objectives are the conservation and sustainable use of plant genetic resources for food and agriculture and equitable benefit-sharing for sustainable agriculture and food security. The Conference of Parties (COP) of the CBD established a programme of work on agricultural biological diversity in 1996, and adopted further elaborations in 2000.

This Symposium was held just prior to the 7th meeting of the CBD's Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA-7), which planned to consider progress made on implementing the programme of work on agricultural biodiversity, as well as the International Pollinators Initiative established by the COP in 2000. The organizers expected to forward a report to SBSTTA to help inform its work in this area.

REPORT OF THE SYMPOSIUM

Edwin Gyasi, University of Ghana and Leader of West Africa Cluster of Project on People, Land Management and Environmental Change (PLEC), chaired the Symposium's opening session and welcomed participants to Montreal. Deborah Buszard, Dean of Faculty of Agriculture and Environment, McGill University, stressed the importance of work on biodiversity in agricultural ecosystems and explained the University's focus on environmental issues.

Coosje Hoogendroom, Deputy Director General, IPGRI, commented on the importance of the Symposium's topic. She over-viewed IPGRI's work and projects, summarizing its mission as "diversity for development" and highlighting its close working relationships with partner research organizations, the Convention on Biological Diversity (CBD) and the Food and Agriculture Organization (FAO). She noted that IPGRI's work on social and economic

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issues, capacity building, conservation of diversity, and use of plant genetic resources are directly tied to the conservation of agricultural biodiversity.

Hamdallah Zedan, CBD Executive Secretary, briefed participants on the history of the Convention, underlining its forthcoming 10th anniversary and its continuous work on agricultural biodiversity under both thematic and cross-cutting programmes of work. He informed participants that the 7th Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) meeting would include a focus on agriculture and biodiversity and commended this Symposium's great contribution to SBSTTA-7's deliberation on the same issue. He also drew participants' attention to the newly adopted International Treaty on Plant Genetic Resources under the auspices of the FAO and to the discussion on access to benefit sharing through genetic resources under the CBD, stating that these are the breakthroughs in the area of agricultural biodiversity conservation.

Motoyuki Suzuki, Vice Rector of the UNU, introduced participants to work on managing agricultural biodiversity done by PLEC since 1992. He highlighted the topic's importance, stating that the future of agriculture depends on the sustainable management of biodiversity on and around farms of the world. He emphasized that this Symposium is a presentation of various studies and research conducted by scholars, scientists and experts in demonstration sites around the world regarding effective management of agricultural biodiversity. He then declared the Symposium officially opened.

MANAGING DIVERSITY: CROP AND LIVESTOCK GENETIC RESOURCES

Participants considered this thematic area in three sessions on Thursday, 8 November. Two focused on crop resources and one on livestock resources.

MANAGING CROP GENETIC RESOURCES: Yiching Song, Center for Chinese Agricultural Policy, Chinese Academy of Science, chaired a morning session and Isabella Massinde, Rural Agriculture and Pastoralism Programme, Kenya, chaired an afternoon session on managing crop genetic resources. Devra Jarvis, IPGRI, provided an overview of the Symposium structure.

Presentations: In a presentation on managing plant genetic diversity in agro-ecosystems sustainably, Tony Brown, Center for Plant Industry (CSIRO), Australia, noted some of the ways that current research tools contribute to our knowledge of genetic diversity. Our facility for accumulating DNA sequences is rapidly expanding; dating processes allow us to determine the timing of genetic splits; and by using microarrays, we can test for gene action and adaptation at much wider levels than previously possible. Brown discussed: the relationship between genetic markers, morphological characters and response to environmental conditions; factors affecting genetic diversity; population monitoring of numbers and sizes, and population genetic analysis; farmers' use of diversity; impacts of intra-specific genetic variability on biotic interactions with a host plant; the impact of participatory plant breeding on maintenance of diversity; and the importance of reserve areas as sources of indicator information about wild species *in situ*. He stated that there is need to have a diversity "indicator." He suggested that some aspects of genetic diversity might help fill that need. However, he noted problems regarding crop-name reliability and the multiple ways to measure genetic diversity. Brown also noted that levels of genetic diversity reflect recent history, such as genetic bottlenecks or inadequate seed supply, and the general sustainability of a system depends in part on intra-specific diversity of function, as varia-

tions in adaptation enable a crop population to cope with stress. He recommended that indicators for monitoring and management of genetic diversity should track population, genetic structural and functional diversity. He concluded by suggesting that a better understanding of genetic diversity can lead to improvements in farms and communities.

Mohamed Sadiki, Moroccan Department of Agronomy and Plant Breeding and IPGRI, discussed the diversity of "farmer-named" faba beans in Morocco. His research considered whether farmer-named cultivars are genetically different from each other. He conducted surveys and investigations based on a participatory approach with 184 farms surveyed. The project summarized cultivar traits, distinguishing between types, within types and the percent of farmers using those traits. Farmers distinguished 22 different cultivars, but there was only partial consistency. In some instances, more than one name corresponded to the same type or trait and in other instances, farmers asserted that there was variation within a single type. However, there was good consistency between morphological characterization of traits and farmers' own set of traits. The accuracy of farmers' ability to identify genetically distinct cultivars affects the ability to use those names as conservation units. Sadiki concluded that conservation managers can use, but may not entirely rely upon, farmer names for development of conservation action plans. He suggested that a better unit for conservation planning might be a group of farmer-named faba bean cultivars that share the same set of descriptors. He also concluded that the genetic structure and distinctiveness of the units managed by farmers are important for agricultural development because they can be used to quantify the amount and distribution of genetic diversity maintained on a farm. He noted two gender-based differences. In farm activities, women bore more responsibility for tasks such as hand seeding, weeding and harvesting. In naming traits, women were more specific about certain aspects such as cooking and overall quality.

Raul Critobal Suarez, National Institute of Fundamental Tropical Research (INIFAT), discussed the contribution of home gardens to *in situ* conservation of plant genetic resources in farming systems. His study, based on selected home gardens in the western, central and eastern regions of Cuba, shows that home gardens host a large number of cultivated and wild species with great variability, and that use of home gardens has become a dynamic agriculture system, providing great food support to local people. His research finds that farmers have facilitated ample exchange of genetic materials between the gardens and their surroundings, making a substantial contribution to *in situ* conservation of plant genetic resources, which is otherwise quite limited in Cuba.

Truong Van Tuyen, Hue University of Agriculture and Forestry, discussed farmers' management of crop diversity in coastal agro-ecosystems of the Hue region in central Vietnam, in which residence, gardens and rice fields are typically integrated. His study explains factors that have caused changes in rice diversity in that region, including rainfall distribution and catastrophic flood problems. It also shows that farmers are not able to obtain their preferred cultivars because the seeds are not available through informal or formal seed systems. He discussed two issues to be addressed for on-farm conservation of landraces: improving seed banks at household and community levels, and including traditional varieties into the formal seed systems. Several responses to the problems observed were highlighted: building awareness of agro-diversity activities; fighting catastrophic floods; growing different varieties among households; and setting up strong communication systems within communities.

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Fetien Abay, University of Makil, discussed local innovation and initiative in managing biodiversity in Northern Ethiopia. She described, for several species and varieties, differences in characteristics such as pulp, flower color, shape, fruit size and taste, length of maturation time, and shelf life. A local planting diagram showed how farmers sought to maximize output in a small plot by prioritizing crop placement and taking into account variation in soil conditions. Abay described a planting strategy that mixed different crops, such as barley and wheat, or different varieties of wheat, in the same plot. Intra-species diversity within the same plot allowed farmers to extend the growing season for a particularly important crop. She observed that introduced or modern varieties might have a difficult time keeping up with rapidly changing environmental conditions as compared to a mixed crop.

Joyce Mulila-Mitti, INSAKA, discussed the role of seed gardens in enhancing local seed security and the use and conservation of agricultural biodiversity for small-scale farmers in Zambia. The farmers face a variety of problems including: exposure to use of hybrid seed and fertilizer; devastating droughts; poor access to seed of modern varieties; poor access to credit for seed and fertilizer; and seed loss during storage. Production of seed in seed gardens during the off/dry season was initiated to offer an alternative or complement to main-season seed production and to help prepare farmers for the main growing season. The project required: selection of suitable sites that had access to adequate water and proper fencing; mobilization of farmers; training in improved seed technology; and field days for sharing among farmers. She said seed yields were higher than expected without seed gardens and seed and food security were enhanced. Seed gardens also improved planning for the main season, increased the market for seed and grain and helped develop seed policy. Enhanced agricultural biodiversity was shown by increased crop/variety diversity; reduced pressure on local landraces to meet all food and income needs; and increased opportunity for off-season production of otherwise ecologically unsuitable crops. Mulila-Mitti suggested that seed garden projects are most effective when the crops/varieties have characteristics suited to farmers' needs, such as early maturation, drought resistance, good storage qualities, and consistency with rotational needs. Other important factors include improved seed management, health and community cooperation.

Oliver Coomes, Associate Professor in the Department of Geography, McGill University, discussed crop diversity in indigenous farming systems in Amazonia and the role and dynamics of planting stock among traditional farmers. His study on the nature and origins of crop diversity, across and within the region, showed that traditional farmers are informally exchanging planting stock among local communities, which also greatly facilitates the transmission of planting stock within the region. This exchange of agricultural planting stock highlights the role that traditional farmers can play in *in situ* conservation of crop diversity. He concludes that there is an urgent need to conduct a systematic assessment of the geographic and socio-cultural patterns of crop diversity in the region in order to improve the region's agro-biodiversity conservation and agricultural development.

Anil Subedi, Local initiatives for Biodiversity, Research and Development (LI-BIRD), discussed how local farmers maintain crop diversity based on a case study in Nepal. His study, conducted in different agro-ecological zones, was designed to understand farmers' decision-making processes, socio-economic circumstances, and environmental factors for the existence and maintenance of crop diversity. The study describes how a seed exchange network has been formed in local communities and among individual farmers and why it plays an important role in maintaining community seed stock and gene banks. The study also demonstrates that we can use such experience to reach other communities and farmers to enhance public awareness about

conserving crop diversity and strengthening local gene bank development. He concluded by stating that farmers are not only the custodians, but also the managers of crop diversity and therefore on-farm conservation of crop diversity is possible only through the active participation of farmers.

Discussion: Didier Balma, Institute of the Environment and Agricultural Research, Burkina Faso, led the discussion following the morning presentations and Devra Jarvis, IPGRI, led the discussion following the afternoon presentations.

One participant questioned whether the high consistency between farmer-named cultivars and genetic diversity was likely in other species, and suggested that bean crops might be relatively easy to recognize. Sadiki noted that genetic differences among bean cultivars might be easier to identify than differences among cultivars of other crops because farmers use the bean pods and seeds.

Another participant asked whether there are criteria for classifying a crop area as a "home garden" and stressed the importance of having a common definition in terms of comparative research. Regarding indicators and the potential impact a target level of biodiversity might have on landraces and gene combinations, participants noted that we are only beginning to grapple with the idea of indicators. Regarding sharing knowledge about genetic diversity among farmers, presenters said their projects were generating knowledge about available varieties and increasing the exchange of seed and germ plasm.

In response to questions, Subedi said how long a local community keeps its seed stock depends on the scale and quality of the seed flow and maintenance. One participant commented that focus should be given to access to diversity, especially given the cost and its social and economic implications. In answering a question regarding how food demand influences crop diversity activity in the indigenous Amazonia region, Coomes said farmers are willing to open up for new seed experiments. In response to a question relating to intellectual property right protection of farmers' knowledge, Mulila-Mitti said the government of Zambia is taking measures to protect farmers' rights.

MANAGING LIVESTOCK GENETIC RESOURCES: Beate Weiskopf, Partner for Perspectives Worldwide, Germany, chaired an afternoon session on the management of livestock genetic resources. She noted that, despite its importance regarding security and food, this area is "neglected."

Presentations: Istvan Szalay, Association of Small Animal Breeders for Gene Conservation, Hungary, spoke about livestock diversity in Eastern Europe. The Carpathian Basin was the geographic subject of his talk. This area comprises several countries and different traditions and supports a number of domestic breeds found only in that region. He reviewed the color varieties in some species of poultry, waterfowl and rabbits and described the Hungarian governmental subsidy system for conservation of livestock diversity and other governmental, institutional and private activities related to gene banks and breeding. As an example of the value of applied research, he described a research study that showed free-range chickens had higher body weight, decreased feed intake, and decreased mortality than cage-bred chickens. Szalay commented on the need for additional basic research, especially in the areas of reproduction biology, natural rearing of indigenous breeds, crossing experiments and ecological farming. He suggested that, through a combination of breeding programs, traditional plant and animal production and cultural sensitivity, the diversity associated with indigenous breeds can be maintained and conserved.

Jenny Bester, Animal Improvement Institute, South Africa, spoke about the Nguni, an indigenous breed of cattle noted for its hardy traits, early maturity, long reproductive life, good foraging abilities, resistance

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to diseases and ticks, and cross-breeding characteristics. The introduction of European livestock during colonial periods has led to interbreeding with indigenous animals, which caused gene and breed replacement and, eventually, a governmental policy geared toward elimination. Some populations survived and scientists began to recognize the value of indigenous livestock. But the quality of the remaining Ngunis had declined along with its numbers. A recent project sought to re-establish Ngunis into selected communities and to create a superior resource base. Bulls were evaluated and bought from commercial farmers. To be eligible for distribution, farmer groups had to be organized and able to contribute towards maintenance. The project has introduced approximately 50 animals into 11 communities and has another 500 animals available. The project provides assistance with breeding and genetic evaluation, provides marketing support including product development, helps link farmers to the market and assists with export. Identified restraints and obstacles include: lack of record keeping regarding progeny performance; lack of grazing, herd and reproductive management; infrastructure deficiencies, such as fencing; and gaps in disease control. Cultural practices, such as community-based decision-making, can hinder outcomes. Land tenure can limit the ability of farmers to act. And a lack of control over satellite gene pools could reduce the quality of the population through interbreeding. Overall, Bester believes that the project demonstrates that conservation is possible through utilization.

Joyce Njoki Njoro, Intermediate Technology Development Group, presented a case study on community livestock improvement initiatives conducted in Kathekani, the eastern part of Kenya. She described the initiative as a community group approach designed to: build strong local capacity to address livestock production; improve household income through sales of goats; and exploit existing local livestock gene pools to achieve higher production. The approach adopted by farmers is communally managed utilization of locally available goat genetic resources, particularly the Galla goat and Eastern African goat, which are well suited to the harsh conditions of that region. The breeding program is guided by a clear goal of improving goat production and has taken into consideration elements such as: mating control; selection of bucks; distribution of bucks among local farmers; disease control; feeding; and general animal husbandry. She emphasized that local breeding should be integrated holistically and *in situ* conservation measures can only succeed if farmers receive direct benefits.

T.N.P. Gondwe, University of Malawi, presented an ongoing project on community-based promotion of rural poultry diversity, management, utilization and research in Malawi. The project, undertaken in the central region of the country, aims to operate through open-nucleus breeding centers established in rural communities and managed by a committee of farmers. Species and strains of poultry involved in the project include chickens, pigeons and ducks. They are raised and evaluated at the centers and will be selected according to their performance as breeding stock for local farmers through local traditional stock sharing systems. During the raising and selection process, technical interventions are made to guarantee improved productivity, such as Newcastle disease vaccination, feed supplementation and early weaning. Gondwe discussed some of the major constraints in conducting the project including: Newcastle diseases; predator harassment; poor housing; prolonged weaning; and the current haphazard breed stock sharing and breeding systems. He also highlighted some principles in securing the project's success including: full participation of local farmers; the community's power to make decisions; use of locally existing species; and exploitation of traditional knowledge possessed by farmers.

Discussion: Ela Martyniuk, National Animal Breeding Centre, Poland, led a discussion following the presentations. One participant expressed concern over transmitted diseases from breeding programmes among various species of livestock. Bester, in response to comments, stressed that it is extremely important to make sure that all genes are kept in conducting cross breeding, because cross breeding can be problematic if gene traits are lost. Some participants commented that it is hard to judge the value of promoting indigenous breeding as opposed to exotic breeding. One participant also drew attention to the long-term implications of stock breeding activities, such as possible soil erosion.

MANAGING DIVERSITY: ASSOCIATED BIODIVERSITY AND AGRO-ECOSYSTEM SERVICES

Sessions on this thematic area began on Friday morning, 9 November, and covered four topics: managing soil biodiversity; managing pollinator diversity; managing diversity for pest and disease control; and managing the impacts of agriculture on wild biodiversity.

MANAGING SOIL BIODIVERSITY: Michelle Gautier, CBD, chaired a morning session on managing soil biodiversity.

Presentations: Mike Swift, Director, Tropical Soil Biology and Fertility Programme, Kenya, provided an overview on management of below-ground soil biodiversity. He highlighted the enormous diversity of the soil community and the critical role that soil organisms play in providing specific soil-based ecosystem services including: nutrient cycles; atmospheric composition and climate regulation; water supply; and biological pest control. He suggested that a key functional-group approach would be useful for management purposes and identified and discussed the services provided by the following groups: micro-fauna; micro-regulators; micro-symbionts; soil-borne pests and diseases; carbon and nutrient transformers; and decomposers. Regarding the impacts of land use change, Swift proposed two pathways for management of below-ground biodiversity: direct manipulation, such as biological control through introduction of bacteria; and indirect ecological control, such as choice of plants or management of organic inputs. The indirect approach appears to hold more promise as a management focus. He said there is a link between above- and below-ground diversity and underscored the value of managing soil organic matter to enhance overall biodiversity. He said the best options for biological soil management will be found in emergent systems, as opposed to highly complex, well established systems or intense monocultures, where opportunities to intervene are limited. Swift also noted that, although land use changes may be the immediate proximate cause of biodiversity loss, the causes involve much more than just the farmers' management activities.

Fidelis Kaihura, Agricultural Research and Development Institute, described a comparative study of soil management strategies on small farms in sub-humid uplands and semi-arid lowlands in Tanzania. Agroforestry dominates in the sub-humid uplands, while agro-pastoral is the predominant farming activity in the wetter lowlands. Soil types differ between the sites in a number of ways, including textual composition, organic components and ability to hold nutrients. Sites with better soils were more intensively managed. Differences in soil management at the individual farm level were mostly due to farm size, access to inputs, ability to cope with changes in soil quality, and farmer-accumulated knowledge in soil management. Sites owned by poor farmers showed more species richness; however, those species had a lower utility index. Kaihura suggested that this result reflects the need of poorer farmers to achieve additional objectives, such as soil improvement or production of livestock feed. Thus, poor farmers exploit biodiversity as a mechanism for soil fertility improvements while rich farmers obtain diverse uses from the crops grown. He said poor farmers are the custodians of biodiversity. Natural and fallow systems with minimum disturbances

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were relatively higher in soil productivity and biodiversity than continuously exploited farms. Irrespective of sites, most strategies used are low input and seek to improve the soil, which, in turn, leads to increases in vegetation and enhancement of on-farm biodiversity.

Michael Stocking, University of East Anglia, UK, and PLEC, focused on soil management by farmers. While noting some environmental degradation problems associated with soil erosion, he also declared that there are "good news" stories; many small-holder farmers worldwide have been managing their land to better conserve biodiversity, particularly in Asia, Africa and South America. A PLEC project has attempted to capture examples that indicate interactions between rural livelihoods and biodiversity. He said that, as a subset of agro-biodiversity, soil agro-biodiversity is the conceptual framework for a managed agricultural system focused on the interactions of humans and soil, and soil and plants. Soil agro-biodiversity is characterized by its beneficial attributes at three levels: site-based benefits, which include increases in soil resilience; management and organizational benefits, which result in less effort to weed or maintain production; and landscape and social benefits, which include diversification of local economies and rural livelihoods.

George Brown, National Center of Research of Soy, introduced a preliminary analysis on the diversity and the functional role of soil macrofauna in Brazilian no-tillage systems. According to his research, the use of no-tillage as opposed to conventional tillage practices can enhance soil macrofauna populations and their contribution to soil function, leading to a more balanced community composition. The soil macrofauna includes invertebrates considered as pests and/or as beneficial to the soil environment and plant production. Ants, termites, earthworms and many others all form part of the soil macrofauna. This research suggests that the diversity of macrofauna groups in no-tillage is significantly higher than in conventional systems, and that crop rotations tend to enhance the positive effects. They also highlight the importance of those organisms that form the soil macrofauna community to soil function and ultimately in enhancing soil fertility, crop production and agricultural sustainability.

Felix Dakora, University of Cape Town, discussed managing diversity in cropping systems, particularly symbiotic and nonsymbiotic microbes, and associated host plants, based on experience in South Africa's tropical areas. He said microbes are a major component of biodiversity in cropping systems and can increase grain yields through their mutualistic and symbiotic interactions with host plants. Mixed intercropping of traditional tropical agriculture allows for greater exploitation of symbiotic microbes and/or better control of microbial pathogens for higher yields. In addition, species of soil (mainly rhizobia) produce chemical molecules that promote plant growth, and they individually and collectively affect biodiversity in the cropping system. With these significant findings, the case study has provided some new insights into how management of microbial biodiversity and the associated host plants can enhance productivity in natural and agricultural ecosystems.

Discussion: Sally Bunning, FAO Land and Water Development Division, led the discussion on managing soil biodiversity and stressed its importance for food security and environmental benefits. She noted that the CBD Secretariat has identified soil biodiversity as an important issue for attention. She observed that the presentations focused on indirect management of soil biodiversity, and commented that socio-cultural considerations should be primary factors in any assessment. She also highlighted the need to focus on restoration of degraded soil.

In response to a question about developing certified indicators, Stocking stated that he recently suggested using 14 indicators related to changes of soil and five related to changes in production. To be useful, indicators must be semi-quantitative and field-friendly.

MANAGING POLLINATOR DIVERSITY: Peter Kevan, Department of Environmental Biology, University of Guelph, chaired the session that focused on management of pollinator diversity. He underscored the importance of pollinators to agricultural and native systems and said that, although concerns about declines in pollinators have been around since before Darwin, pollinator conservation is only recently beginning to get some much-needed attention.

Presentations: Wanja Kinuthia, National Museums of Kenya, Dept. of Invertebrate Zoology, described pollinators as an "ecosystem service for agriculture." Many important crops, such as soybeans, ground nuts, mangos, coffee, oil of palm and other vegetables, are pollinated and show a direct decline in yield when pollinators are not present. In Africa, many subsistence farms are located close to natural habitats. Cultivated plants usually have wild relatives. Thus, cultivated crops and wild plants can share pollinators and the wild areas provide an additional "reservoir" habitat for pollinators after the growing season. In the riverine acacia woodlands of Kenya, research has shown temporal differences in visitations between native bees and honeybees. Native bees are relatively more abundant later in the morning than the honeybee. This difference suggests that the native bees are better adapted to the local climate and able to pollinate during hotter weather. Such differences show that pollinators are a complex of species with unique requirements for survival and highlight the need for caution regarding pollinator introduction. Kinuthia suggested that national policies on agro-biodiversity should include pollinators and stressed the need to: overcome taxonomic impediments; determine the effects of invasive species and plants; and determine the economic benefits of pollinators.

Connal Eardley, Agricultural Research Council-Plant Protection Research Institute, discussed the "plight of the bee" in South African semi-deserts, which support unique fauna and flora. Land changes in the semi-deserts have negatively impacted pollinators, but the scope of the impact is poorly known. Long occupied by herders, the semi-deserts underwent changes to vegetation composition after the onset of European farming. Certain land use practices appear to be favoring certain species of bees over other ones. Current land use activities threaten the abundance and diversity of bees in a number of ways including: livestock depletion of plants; livestock trampling of soil and compaction of essential habitat; removal of dry wood used by bees; water pollution; depletion of water used to construct mud nests; and insecticides. He underscored the need to: study the causes of and monitor pollinator decline; study impacts on pollination; address the lack of taxonomic information on pollinators; adopt standardized methodologies; assess the economic value of pollination and its loss; encourage use of indigenous pollinators in agriculture; and promote conservation, restoration and sustainable use of pollinator diversity.

Nasreen Muzaffar, Director of the Honeybee Research Institute of Pakistan, discussed the sustainable management of insect pollinators in Pakistan, focusing on a community-based participatory approach that demonstrates the creation of best conditions for diversification of farm income. The demonstration project is conducted in diverse agro-ecological areas in Pakistan's northern mountains and plains, in which honeybee and non-*Apis* bee populations were integrated to promote insect pollination processes for crop planting. During the demonstration project, on-farm pollination trials were conducted on various crops including apples, almonds, pears, sunflowers and cucumbers. The trials

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indicated that plants visited by honeybees and native non-*Apis* bees all showed higher yields than those not visited by pollinators. The economic gain by local farmers through high yields of crop production as well as sale of honey and honeybees is considerable. The project clearly shows the local farming communities that honeybees and other insect pollinators are essential for successful cultivation of their crops and improvement of their livelihoods. At the same time, insect pollination also helps to ensure conservation of biological diversity, sustainable habitats and the overall ecosystem.

Discussion: Barbara Gemmill, Environment Liaison Centre International, led a discussion following the presentations. Kevan introduced research work on insect pollination in Central and South America. In response to a question regarding disease transmission by insect pollinators, Muzaffar said pesticide application is necessary to control disease. One participant asked how genetically modified plants would affect insect pollinators such as bees and Muzaffar said that, so far, the impacts are positive.

MANAGING DIVERSITY FOR PEST AND DISEASE

CONTROL: Daniel Buckles, International Development Research Center, opened an afternoon session on pest and disease control.

Presentations: Bill Settle, Center for Agro-ecology, University of California, Santa Cruz, spoke about functional diversity and integrated crop management. He described the linking function that certain species provide between soil and aquatic foodwebs and above-the-water foodwebs in irrigated tropical rice ecosystems. "Linking" species emerge before the rice is planted, well in advance of potential rice pest species. Population levels of beneficial predators closely track those of the linking species, but are not temporally correlated with arrival of pest herbivores. As a result, there is a diversity of beneficial predators already on site ready to take advantage of the herbivorous pests. Adding organic matter to the system boosts populations of the linking species while simultaneously increasing rice yield. The use of insecticides threatens this natural pest-management system by resulting in resurgent outbreaks after the initial suppression. At the landscape level and with respect to beneficial predators, he concluded that areas of high global disturbance and synchronous planting favor long distance travelers, high fecundity and relatively large and robust arthropods, while areas of low global disturbance and heterogeneous plantings favor long-lived generalists and highly efficient searchers. In the synchronous plots, predator arrival dates were significantly delayed and it took much longer to attain the same level of abundance as that found in heterogeneous plantings. He noted that synchronous planting also can negatively impact the stability of labor requirements, input costs and harvest prices. He concluded that species diversity is a correlated factor to ecosystem functioning.

Wang Yunyue, Phytopathology Laboratory of Yunnan Province, Yunnan Agricultural University, China, discussed cultivating biodiversity for disease control. Blast is the main disease of rice in Yunnan Province. Her case study examined the relationship between variety diversity and rice blast management in a total of 458 large-scale field experiments. She concluded that variety diversification provides an ecological approach to disease control. When disease-susceptible rice varieties were planted in mixtures with resistant varieties, the occurrence of rice blast was 84% less severe than varieties grown in monoculture. The benefits of mixture planting also showed up in increased yields. High quality varieties planted in mixtures with hybrid varieties had strong resistance to blast and there was a 100% rice yield increase. Disease-susceptible rice varieties planted in mixtures with resistant varieties showed an 89% greater yield than when grown in monoculture. Farmers also experienced cost savings of approximately US\$72

per hectare from reduced pest pressures. The idea of using diversification to control diseases and insect pests has been extended to mixed crops, such as wheat and broad bean. The intercropping design reduced the incidence of rust by 19-27% and damage due to bean stem maggots decreased to minimal levels.

Yunita T. Winarto, University of Indonesia, discussed managing paddy and soybean varieties in Java and Lampung, including two cases of farmer creativity connected with FAO's integrated pest management (IPM) program. She described farmers' experiences managing crop biodiversity in paddy and soybean farming on the north coast of West Java and Central Lampung. On the north coast of West Java, farmers continued to plant new rice strands, with the results of diverse rice varieties planted in each season, despite the "recommended uniform" strategy of rice farming by the government. In the central Lampung case, after experiencing repetitive failures with soybeans, farmers improved and developed various strands of soybean varieties in order to produce "free-pesticide-soybean" crops in a sustainable manner. The study shows farmers' learning experience in planting rice and soybeans through various sources, including crop performance, pest control experiments, market demand and price, and neighbors' choices for seeds. It also shows ways that farmers evaluate and improve their knowledge and practices, which help to increase crop variety and ultimately promote diversity for pest and disease control. In conclusion, she stressed that many social and economic factors have to be taken into consideration to make farmers' sustainable agriculture dream a reality.

Discussion: Toby Hodgkin, IPGRI, led the discussion following the presentations. One participant commended FAO's IPM program and suggested it should be strengthened, stressing that more actions need to be taken to promote crop varieties. Other questions and comments were related to monoculture practice and traditional planting practices and decomposition in functional diversity for integrated crop management.

MANAGING THE IMPACTS OF AGRICULTURE ON WILD BIODIVERSITY: Timo Maukomen, UNEP, chaired an afternoon session on agriculture and wild biodiversity.

Presentations: Colin Duncan, Department of History, School of Environment, McGill University, spoke about agriculture and biodiversity loss throughout history. Massive conversion of forest and grasslands to agriculture has taken place over the last several millennia and that conversion has resulted in a tremendous loss of biodiversity. However, more complete assessments of biodiversity loss suffer from a serious lack of adequate data. The rate and degree of native forest depletion has differed by location. In coastal China, the removal of the native forests appears to have been slow but was eventually total. In Europe, removal also was slow, but more wildwood was allowed to remain and hedgerows and other refugia were made. The creation of refugia in the agricultural landscape arose in complex crop rotation systems. These refugia probably enabled persistence of certain soil micro-flora and the preservation of many species. Modest changes to ecosystems, such as light burning and grazing and even irrigation, may have opened new niches, leading to some increases in biodiversity. Yet, when practiced more widely, such activities can reduce biodiversity. Current deforestation in areas such as the Amazon basin are more dramatic in terms of biodiversity reduction, because the indigenous biodiversity is very high. Rapid and complete removal also has impacts on conditions such as climate.

Raymond O'Connor, University of Maine, spoke about agricultural regimes and the conservation of farmland biodiversity. In particular, he discussed how birds have responded to changes in habitat alterations, agricultural intensification, stock management and pesticide use. Many microhabitats are characterized by elements such as openness, fields,

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hedge density, ponds and linear water, which are determinants for the presence of different bird species. Alteration of habitat affects bird species composition. As drainage of land increases and wetlands and ponds disappear, the abundance of certain water-dependent species decreases. Intensification of agriculture requires large combines and straight rows, which eliminate important habitats such as hedgerows. Changes in crop management, such as combine harvester use, stubble burning and chemical use, affect prey availability, habitat and timing issues. Pesticides and herbicides affect bird species by depleting their food supply. The effect can be dramatic if multiple changes occur at the same time. When density of livestock is intensified, bird populations decline. O'Connor estimated that as many as 17 species are "missing" from the Midwestern United States as a result of agricultural practices. He estimated that 42 to 90 million birds are missing because of pesticide application. Thus, agricultural practices at the individual farm level and landscape level have had major impacts on birds.

Sara Scherr, Agricultural and Resource Economics Department, University of Maryland, discussed eco-agriculture as a new form of agriculture, designed to raise farm production and incomes while increasing wild biodiversity, particularly in biodiversity hotspots. She stated that a global review of population, food demand and agricultural management has indicated that wild biodiversity conservation will not be successful unless fundamental changes are made to agriculture. Eco-agriculture is built on the concept of ecosystem management, by increasing wildlife habitats in non-farmed patches in agricultural landscapes and by enhancing the habitat quality of productive farmlands. Concrete measures for adopting eco-agriculture approaches include: creating more biodiversity reserves; preventing conversion of wild land into agriculture; crop intensification; and strengthening pest management. A broad range of actions were proposed to promote eco-agriculture on a scale sufficient to make a significant contribution to conserve global biodiversity, increase food production and raise incomes.

Discussion: Don Smith, McGill University, led a discussion following the presentations. In response to questions on the policy issues associated with supporting eco-agriculture, Scherr noted that efforts are underway to encourage farmers to adopt eco-agriculture approaches, including providing farmers with biodiversity services, product labeling and community-based land planning. In exchanging views on maintaining the balance between farmers' economic considerations and wild biodiversity conservation, one participant expressed concern over the lack of farmland that might make eco-agriculture unrealistic, with another noting that increasing the wildlife population in some regions has already caused battles over lands between farmers and animals. Participants also stressed the importance of institutional arrangements in promoting eco-agriculture.

MANAGING DIVERSITY: LANDSCAPE, SCALE AND CHANGE

Symposium participants discussed the third and final theme, "Managing Diversity: Landscape, Scale and Change," on Saturday, 10 November. Three sessions were held on two topics: managing diversity in the agricultural landscape and managing diversity under global change.

MANAGING DIVERSITY IN THE AGRICULTURAL LANDSCAPE: Harold Brookfield, Department of Anthropology, Australian National University, welcomed participants to the final day of presentations and chaired morning and afternoon sessions on diversity in the agricultural landscape.

Presentations: Miguel Pinedo-Vasquez, Columbia University, discussed valuing and promoting small-holder agricultural practices based on a PLEC research project conducted in Amazonia, South

America, West and East Africa, and Asia. The project focuses on three major issues: the diversity of systems in production landscapes; multiple functions of small-holder production systems; and an expert farmer demonstration approach. With regard to diversity of systems in production landscapes, the example of Amazonia in Peru shows how farmers use their resources to cope with landscape change problems due to catastrophic floods. Regarding multiple functions of small-holder production systems, pilot sites in Brazil, China and Kenya demonstrate farmers' practices in: creating and managing microhabitats for more plant species; using multiple cropping systems to cope with market changes; and developing agro-forestry systems to manage disease control. Regarding demonstration of various approaches, it was noted that expert farmers play a significant role in setting up demonstration objectives and developing and modifying demonstration techniques.

Mahmadou Sawadogo, Institute of the Environment and Agricultural Research, spoke about how farmers in three regions in Burkina Faso use ecosystem indicators to conserve, maintain and manage local crop diversity. His investigation used, *inter alia*, direct surveys, focus groups and climatic mapping. The project involved three sites with six villages per site, 18 families per village, and six crops. He sought to: determine and map the actual distribution of farmers' varieties; describe and map the factors that affect diversity; and determine the relationships between these factors and diversity in farmers' varieties. Diversity was calculated by number of varieties of each crop. Farmers used information from the ecosystem to determine when to begin planting. Indicators relied upon included: plant activity, such as leafing or fruiting; activities of birds and animals; star constellations; and traditional rituals. Farmers have reasonably good knowledge about the beginning of the season and about good seasons. The project also looked at the results to determine what type of interventions or actions should be made and in what order. In these arid regions of unpredictable rainfall, diversity is a way of life. Managing crop diversity is a key strategy for guaranteeing food from year to year. Threats to certain key indicator trees threaten this ecosystem-based information source.

Kanok Rerkasem, Faculty of Agriculture, Chiang Mai University, spoke about farmers' management of fallow succession in Thailand at two mountainous sites. Shifting cultivation followed by fallow succession is the predominant practice among certain ethnic minority groups. The area has been subject to rapid change over the last thirty years with the introduction of highland development as the government has sought to eradicate opium crops and protect forests. Rerkasem showed that if the fallow period is too short, agriculture cannot be sustainable. In response to these pressures, farmers have either turned to intensive cash crops or are using agro-biodiversity management of shorter fallow periods to overcome limitations. In one area, farmers' use of a spiny leguminous weed plant for fallow succession has proved beneficial for building soil. At another site, the *Macaranga*, a prolific seed-producing shrub species, is helping to sustain productivity. He concluded that the farmers' innovation offers important information about sustainable land use practices.

Huijun Guo, Vice Director of Xishuangbanna Tropical Botanical Garden, China, discussed agro-ecosystem change and threats to agro-biodiversity in the tropical mountains of Xishuangbanna region. The case study indicates that agro-ecosystems in the region are undergoing rapid and profound changes. Some of the changes are having impacts on agro-biodiversity, such as practices of shifting cultivation including replacement with plantations of industrial crops. When the agro-ecosystem changes, agro-biodiversity is lost. Driving forces for these agro-ecosystem changes include, in particular, land use policy changes, economic market change, agricultural technology changes, and creation

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of biosphere reserves. The presentation outlined some counter-measures to agro-biodiversity loss that local farmers are exploring through new agricultural opportunities associated with diversifying plantations.

Edwin A. Gyasi, Department of Geography and Resource Development, University of Ghana, presented a case study on managing diversity in the agricultural landscape in Ghana. The study describes traditional systems of managing diversity of the biota in agricultural landscapes with a focus on sites of conservation efforts under a PLEC project. He discussed strengths and weaknesses of traditional systems as well as threats posed to them by other social and economic factors, such as production pressures, introduction of exotic systems, and changes of dietary habits. The PLEC project is designed to build upon the traditional systems to conserve agro-biodiversity and to observe how conservation measures affect agricultural landscapes. Gyasi also highlighted the main policy lessons learned from this case study – the realistic policy option for conserving agro-biodiversity and meeting food production challenges should be based on traditional systems and be made an integral part of the whole land use system.

Farida Akhter, Policy Research for Development Alternative, spoke about biodiversity and the livelihood strategies of the very poor in Bangladesh. The majority of poor people are not living on cultivated crops. Instead, the whole landscape is the source of food as the very poor collect food from the lands, water bodies and forests where they live. At least 40% of their daily diet comes from uncultivated foods. The lowest income people are surviving year-round on uncultivated foods. Plant collection is done without damaging the source plant, by carefully plucking from the plant at the right location. They typically collect what they need for a meal but may also sell additional materials at market. Small fish are collected opportunistically from the water bodies. The women are especially knowledgeable about nutritional values of different plants. In recent years, local people have seen an erosion of food supply and related materials, such as cow dung for cooking, possibly attributable to changing agricultural practices, including pesticides or use of tractors instead of cows. The loss of biodiversity also is leading to an erosion of traditional knowledge. Akhter stated that discussions about agriculture should not be limited to one crop, but should include consideration of those who cultivate their landscape.

Discussion: Christine Padoch, New York Botanical Garden, led the discussion after the presentations. She noted the complexity of the different agricultural systems considered and the diversity of responses that farmers have shown in responding to threats and opportunities. Several participants asked how best to upscale the knowledge gained from farmer innovation to build a network of knowledge and influence policy decisions. Speakers' responses included suggestions for identifying universal practices, using extension agents to reach out to governmental officials, greater use of the media, use of songs, metaphor and analogy to transfer knowledge, and a focus on farmers as both experts and learners.

MANAGING DIVERSITY UNDER GLOBAL CHANGE:

Luohui Liang, Managing Coordinator, PLEC/UNU, chaired the Symposium's final session, on managing diversity under global change.

Presentations: Tim Johns, Center for Indigenous People's Nutrition and Environment, McGill University, presented a paper on dietary diversity, global change and human health, in which the close links between those elements were highlighted. He said ingested plant and animal products offer functional benefits to human health in addition to providing essential nutrition. He also noted that some emerging diseases of global importance that have a dietary basis could be better addressed through a diversity of species and genotypes. The paper examined how

traditional systems, indigenous resources and knowledge help conserve diversity, provide adequate nutrition and protect human health. He concluded by stating that: biodiversity leads to dietary diversity and ultimately links to human health; global changes have great impacts on traditional ecology; and there should be a health rationale for managing biodiversity.

David Wood, independent consultant, presented a paper on diversity, simplicity and the optimization of agro-biodiversity. The paper addressed the quantification of biodiversity at genetic, species and ecosystem levels, and how agro-biodiversity is distributed within and between agro-ecosystems. It highlighted the roles of diversity in natural systems and synergies or possible conflicts between ecological and socio-economic consideration for diversity in agro-ecosystems. To illustrate the problems of generalizing the role of diversity, the paper looks at: the role of scale — gardens, fields and landscapes; optimization of agro-biodiversity at a time of changing and uncertain ecological principles; and the place of wider biodiversity in agro-ecosystems in terms of trade-offs between conservation and utilization. The presentation also discussed the relationship between farmers' choice and global needs in a changing setting.

Diddt Pelegrina, Southeast Asia Regional Institute for Community Education, Philippines, spoke about managing agro-biodiversity under changing Southeast Asian market and agricultural production systems, which she said largely requires building social capital. She reviewed the overall context of the production, market and political systems. Within that context she works to build and strengthen social capital to manage local agro-biodiversity to achieve increased production and diversity according to farmers' preferences. The objective is to move from: subsistence farming to marketable yield; conservation to development and use; and single institution to multi-stakeholder participation at high levels of policy making. She underscored the importance of moving from field work to policy discussions and involving groups of farmers who control resources to help manage biodiversity. Successes have included: increased technical capacity; a sense of voice among farmers and farmer groups; increased plant genetic resources; conservation of traditional varieties; and influence on research directions. Challenges include a culture of silence among some communities and the need to use different approaches under different political systems.

Discussion: The discussion on diversity under global change was led by Devra Jarvis. Participants exchanged views on the values and risks of intensive agriculture, chemical use, and creation of refuges. One participant suggested that the development of multi-stakeholder groups should include other workers in the agricultural communities. Another noted the difficulties associated with determining what constitutes ecosystem health, which must involve both diversity and abundance.

CLOSING REMARKS

Jan Plesnik, Chair of SBSTTA-7, chaired the Symposium's closing session. Toby Hodgkin said the Symposium was a learning experience for many participants and it accomplished its goal of exchanging experiences in various parts of the world, with a key emphasis on communication among people working in the same subject matter. He urged participants to integrate case studies and demonstration projects with local practices and to identify gaps for future endeavors. Harold Brookfield pointed out that there is a great deal of similarity in farmers' approaches to conserving agro-biodiversity. Noting that management is the key, he encouraged more discussion on the management level in the future.

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David Cooper, CBD, highlighted some points from the Symposium and suggested next steps. He said the Symposium showed some of the dimensions of diversity, having considered, among others, livestock, livelihood, associated pollinators, pest and diseases, organisms as service providers, the landscape level and the influence that management has on it. He stated that there was no "single axis" for diversity and that we have only begun to integrate these various dimensions. We have begun to appreciate the effects of change over time and such changes can be managed to benefit human livelihood. Cooper highlighted that the many success stories discussed at the Symposium depended on a rigorous interdisciplinary approach and recognized that we must understand the socio-economic elements in addition to the genetics. He said we need a vigorous commitment to work with farmers and that we have much to learn from the variety of approaches discussed. Challenges for future work include: integrating the different dimensions; seeking to understand the complexity; clarifying potentially conflicting goals; developing indicators; and scaling up the successes. He noted that, based on this Symposium, Toby Hodgkin would make a statement to the working group on agro-biodiversity at SBSTTA and proceedings from the Symposium, including abstracts and any papers submitted by year's end, would be published on a compact disc. A book on agro-biodiversity may be published before the 6th Conference of the Parties to the CBD.

Cooper thanked everyone responsible for making the Symposium happen, including its sponsors: UNU, CBD Secretariat, IPGRI, IDRC, FAO, Technical Center for Agricultural and Rural Cooperation, German Ministry for Economic Cooperation and the Development, Japanese Ministry of Foreign Affairs, Swiss Agency for Development and Cooperation, Directorate General for International Cooperation of The Netherlands, McGill University and GEF.

In closing, Jan Plesnik noted that the CBD is a scientific convention and must go to its roots to provide Parties and decision makers with good information. He predicted that we will reach biodiversity at all levels for the next generation and expressed his pleasure that the SBSTTA Bureau would carefully review the outputs of this Symposium. He also thanked the Symposium's sponsors and those who had chaired sessions, led discussions, presented papers and participated. He officially closed the Symposium at 5:30 p.m.

THINGS TO LOOK FOR

SEVENTH MEETING OF THE CBD'S SUBSIDIARY BODY FOR SCIENTIFIC, TECHNICAL AND TECHNOLOGICAL ADVICE: CBD SBSTTA-7 will meet from 12-16 November 2001, in Montreal, Canada. For more information contact: CBD Secretariat, Montreal, Canada; tel: +1-514-288-2220; fax: +1-514-288-6588; e-mail: secretariat@biodiv.org; Internet: <http://www.biodiv.org>

WIPO SECOND SESSION OF THE INTERGOVERNMENTAL COMMITTEE ON INTELLECTUAL PROPERTY AND GENETIC RESOURCES, TRADITIONAL KNOWLEDGE AND FOLKLORE: This session will be held in Geneva from 10-12 December 2001. Participants will consider a variety of issues, including access to genetic resources and benefit-sharing, and protection of traditional knowledge, creativity and folklore. For more information contact: Francis Gurry, Assistant Director-General of the World Intellectual Property Organization; tel: +41-22-338-9428, e-mail: francis.gurry@wipo.int

REGIONAL CONFERENCE ON PUBLIC PERCEPTIONS OF BIOTECHNOLOGY IN AFRICA: This meeting will convene from 28-29 January 2002, in Nairobi, Kenya. For more information contact: Anna Ogalo or Harrison Maganga, African Centre for Technology Studies, Nairobi, Kenya; tel: +254-2-524700/6; fax: +254-2-524701; e-mail: acts@cgiar.org or a.ogalo@cgiar.org; Internet: <http://www.acts.or.ke>

INTERNATIONAL CONFERENCE ON IMPACTS OF AGRICULTURAL RESEARCH: This international conference will take place from 4-7 February 2002, in San José, Costa Rica, and is being organized by the International Centre for the Improvement of Maize and Wheat (CIMMYT), in partnership with the Standing Panel on Impact Assessment of the CGIAR's Technical Advisory Committee. The conference will assess the impacts of agricultural research and development and examine why impact assessment research has not had more of an impact. For more information contact: Prabhu Pingali, Director of CIMMYT's Economics Programme, Mexico City, Mexico; tel: +52-5-804-2004; e-mail: impacts@cgiar.org; Internet: <http://www.cimmyt.org/research/economics/impacts>

MEETING OF THE AD HOC INTERSESSIONAL WORKING GROUP ON CBD ARTICLE 8(j): This meeting is scheduled to take place from 4-8 February 2002, in Montreal, Canada. For more information contact: CBD Secretariat, Montreal, Canada; tel: +1-514-288-2220; fax: +1-514-288-6588; e-mail: secretariat@biodiv.org; Internet: <http://www.biodiv.org>

BIOTECHNOLOGY AND SUSTAINABLE DEVELOPMENT - VOICES OF THE SOUTH AND NORTH: This international conference will take place from 16-20 March 2002, in Alexandria, Egypt. It is co-sponsored by the Government of Egypt, FAO, UNESCO, World Bank and OECD, among other institutions. For more information contact: Ismail Serageldin, Chair, Program Committee; tel: +203-4876024/4876028/4876052; fax: +203-4876001; e-mail: egybio2001@hotmail.com; Internet: <http://www.egyptbiotech2001.com/>

SIXTH CONFERENCE OF THE PARTIES TO THE CONVENTION ON BIODIVERSITY & CARTAGENA PROTOCOL MOP-1 or ICCP-3: CBD COP-6 will take place in The Hague, the Netherlands, from 8-26 April 2002. This gathering is also expected to serve as the first Meeting of the Parties (MOP-1) or the third ICCP of the Cartagena Protocol. For more information contact: CBD Secretariat, Montreal, Canada; tel: +1-514-288-2220; fax: +1-514-288-6588; e-mail: secretariat@biodiv.org; Internet: <http://www.biodiv.org>

28TH SESSION OF THE COMMITTEE ON WORLD FOOD SECURITY: CFS-28 is tentatively scheduled to take place from 6-8 June 2002, in Rome, Italy, prior to the World Food Summit. For more information contact: Barbara Huddleston, FAO; e-mail: Barbara.Huddleston@fao.org; Internet: <http://www.fao.org/unfao/bodies/cfs/default.htm>

WORLD FOOD SUMMIT – FIVE YEARS LATER: The World Food Summit has been tentatively rescheduled for 10-13 June 2002, in Rome, Italy. For more information, contact the FAO: fax: +39 06 570 55249; e-mail: foodsummit@fao.org; Internet: <http://www.fao.org/worldfoodsummit/>