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# CGRFA Bulletin

**A Summary of the Special Information Seminar on Climate Change and Genetic Resources for Food and Agriculture: State of Knowledge, Risks and Opportunities**  
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## CLIMATE CHANGE AND GENETIC RESOURCES FOR FOOD AND AGRICULTURE: STATE OF KNOWLEDGE, RISKS AND OPPORTUNITIES: 16 JULY 2011

On Saturday, 16 July 2011, in the prelude to the thirteenth regular session of the Commission on Genetic Resources for Food and Agriculture (CGRFA), a special information seminar was held at the headquarters of the UN Food and Agriculture Organization (FAO) in Rome, Italy, under the heading: "Climate Change and Genetic Resources for Food and Agriculture: State of Knowledge, Risks and Opportunities."

In the morning, a panel discussion was held on the risks and opportunities of genetic resources for food and agriculture (GRFA) in the context of climate change, which included presentations on animal, plant, aquatic, forest, microorganism and invertebrate genetic resources.

The afternoon panel addressed challenges and responses in integrating GRFA concerns in climate change activities at different levels, and involved presentations on international, national and community level experiences.

### OPENING SESSION

CGRFA Chair Javad Mozafari Hashjin (Iran) welcomed participants and highlighted that farmers, forest dependent communities and fishing communities, particularly in the developing world, are at the frontline of climate change impacts. He said GRFA are essential for enabling plants and animals to adapt to environmental stresses associated with climate change. He underscored that this should be brought to the attention of the international community to better address the challenges that climate change poses for agriculture and food security.

Ann Tutwiler, Deputy Director-General Knowledge of the FAO, said climate change presents severe and widespread threats to ensuring food security, which urgently needs to be addressed. Noting that agriculture is considered to be part of the climate change problem, she said agriculture should also be part of the solution, and added that adaptation in the agricultural sector is not an option but an imperative for human survival. She highlighted that many countries showed increasing interest in agricultural-related mitigation and adaptation projects at national level, including through related activities in their National Adaptation Programmes of Action (NAPAs).

### CLIMATE CHANGE AND GENETIC RESOURCES FOR FOOD AND AGRICULTURE: RISKS AND OPPORTUNITIES

Moderated by Toby Hodgkin, Platform for Agrobiodiversity Research, the morning panel session focused on the state of knowledge regarding risks and opportunities for agricultural biodiversity in the context of climate change.

**ANIMAL GENETIC RESOURCES:** Irene Hoffmann, FAO, presented on climate change and animal genetic resources (AnGR). She said livestock production is a major contributor to

global emissions of greenhouse gases. Among potential areas for adaptation, she highlighted: increasing heat tolerance and adaptive capacities of all livestock breeds; achieving greater efficiency in production; exploring co-benefits among species and ecosystem services including through, *inter alia*, better use of grasslands, conservation of wild biodiversity in protected areas and high nature value grass lands; and exploring tools such as payments for environmental services schemes. She also highlighted the key role of the Global Plan of Action for Animal Genetic Resources as a framework to address these challenges.

One participant suggested that drought should be considered the major cause for the loss of AnGR. Hoffmann replied that, based on a series of surveys, economic and market drivers have emerged as the main causes, cautioning that focusing on food security risks narrowing down the genetic diversity available to address future adaptation challenges.

**PLANT GENETIC RESOURCES:** Andrew Jarvis, International Center for Tropical Agriculture, presented on risks and opportunities for plant and crop genetic resources. Noting that climatic change will alter the geographic distribution of climate zones, he presented three categories of risks: novel climates arising from new combinations of climatic facts for which currently no adapted species exist; changes in averages and variability leading to more frequent occurrence of extreme events; and accelerating rates of change. He explained that the suitability for the use of crops will change, with the greatest changes expected in areas that are already poverty hotspots.

As main impacts on agricultural production, Jarvis outlined: increasing interdependence in the use of plant genetic resources for food and agriculture (PGRFA), up to 30 percent of land subject to novel climates; and threats to wild species and crop relatives. In closing, he stressed that adaptation options depend on PGRFA as well as the geographic transfer of existing agricultural technologies and practices to adapt to changes in biotic suitability.

**AQUATIC GENETIC RESOURCES:** On aquatic genetic resources, Roger Pullin, FAO Consultant, emphasized that aquatic ecosystems management is key to global mitigation and adaptation strategies. On aquatic genetic resources risks, he stressed ocean acidification as the most worrying trend. On impacts, he noted that inland and coastal fisheries are more vulnerable than ocean and deep-water fisheries, while some aquaculture systems are less vulnerable than others. With regard to adaptation, he outlined opportunities in changing species composition, natural selection in species with high rates of fecundity, and the use of biotechnology applications and domestication of new species. He also recommended considering the inclusion of fish in wetland farming systems and the role of fisheries and aquaculture as a component of global carbon and nutrient cycles.

**FOREST GENETIC RESOURCES:** On forest genetic resources, Bruno Fady, French National Institute for Agricultural Research, explained that the main impacts of climate change will arise from the modification and change in location of suitable bioclimates. He outlined three adaptation

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strategies of trees: the ability of a phenotype to cope with a large range of climatic conditions (phenotypic plasticity); genetic adaptation; and migration. On genetic adaptation, he stressed knowledge gaps regarding: costs, limits and trade-offs; genomics of adaptation and reproduction; science-based collection management; and increasing the genetic basis of forest breeding programmes. On migration, he prioritized the study of fragmented landscape effects and impacts of long distance dispersal, and research on communities of tree species. Regarding priorities of climate change adaptation, Fady stressed valuation of conservation actions, research on assisted migration and gene flow, marginal populations, and improvements in germplasm conservation and characterization.

**MICROORGANISM GENETIC RESOURCES:** Fen Beed, International Institute of Tropical Agriculture, presented on microorganism genetic resources. Despite their relevant role in ecosystem functions and services, he said microorganisms are largely ignored because of their rapid reproduction rates and modes and their restricted capacity to be cultured under laboratory conditions. Among key roles by microorganisms, he highlighted: formation and maintenance of soil structure; nutrient absorption, nitrogen fixation and tolerance resistance to diseases in plants; and as biological control agents. He said precise effects of climate change on microorganisms are difficult to predict owing to the lack of current knowledge.

Among opportunities to adapt to climate change, Beed underscored farming practices that increase biodiversity and ecosystem resilience, including crop rotation and green and organic manure fertilization. He called for the enhancement of: microorganism genetic resources management to buffer, adapt to and mitigate climate change; and mechanisms for their monitoring, research, characterization and conservation. Responding to a question concerning the use of chemical fertilizers, Beed reminded participants that chemical fertilizers imply greenhouse gas emissions and said a combination of natural and chemical fertilizers could be used depending on the biodiversity scenario and the available market conditions on a case-by-case basis.

**INSECT GENETIC RESOURCES:** Matthew Cock, Centre for Agricultural Bioscience International, presented on insect genetic resources and climate change, underscoring their key roles in agriculture, including that they: contribute to essential soil processes that maintain productivity; perform as pollinators and biological control agents; and are a source of food and products. He noted uncertainty about possible climate change impacts on invertebrates, but expected that the majority of invertebrate pollinators, pests and their natural enemies would move with their host plants as crop and forage distributions change. He anticipated an increasing demand for the movement of biological control agents to address new pest problems caused by climate change, but cautioned against movements of soil invertebrates between countries, noting that further implementation of relevant guidelines and policies is needed. He underscored knowledge gaps, including on invertebrate interactions with climate change-related factors, their genetic characterization, and the methods to facilitate invertebrate adaptation.

**DISCUSSION:** The discussion focused on knowledge gaps, the roles of *in situ* and *ex situ* conservation, and mitigation and adaptation. On knowledge gaps, Fady underscored gaps concerning undomesticated tree species, functional types, and inventories. Hoffmann highlighted that a distinction should be made on the different levels of knowledge gaps depending on the sector addressed. She underscored that in the case of the livestock sector few species are used but further knowledge on the impacts of climate change is still needed. A participant highlighted the need to further collect and compile traditional and local knowledge. Another participant said scientific assessments should contribute to implementation and be used

at the national level. Pullin highlighted the need to strengthen information systems for aquatic genetic resources. One participant highlighted knowledge gaps in the study of tropical vulnerabilities and adaptation. Beed supported considering an ecosystem approach and highlighted that centralized inventories and collections could contribute to identify knowledge gaps.

On conservation, several participants called for stronger focus on *in situ* conservation, with panelists noting that *ex situ* and *in situ* conservation are complementary strategies. Cock added that conservation must also ensure accessibility to realize appropriate deployment.

On mitigation and adaptation, one participant underscored the need for the international climate change debate to further focus on adaptation gaps, particularly those in developing countries. He also underscored the need to enhance cooperation between the national ministries of environment and agriculture within countries.

On measures to address vulnerability, Hoffmann highlighted the need for further understanding on the linkages between agriculture and food security. One participant called for more systematic evaluation of accessions of plant genetic resources currently stored in gene banks with regard to their potential use for adaptation.

Panelists also discussed risks associated to the deliberate movement of germplasm and the introduction of species into new environments for adaptation of food and agriculture to climate change, such as alien invasions. Cock called for careful decisions on introductions, which should be taken at the international level and consider the risks of alien invasions. Fady said both local adaptation and foreign introductions will be needed to cope with climate change, whereas Jarvis suggested that technologies and species, as well as traditional knowledge will be needed.

Echoing a suggestion by moderator Hodgkin, Pullin supported an inter-sectoral approach on adaptation. One participant called for conservation as a means to support adaptation in vulnerable regions. On risk quantification, Cock suggested improving data collection for risk modeling.

### **CLIMATE CHANGE AND GENETIC RESOURCES FOR FOOD AND AGRICULTURE: CHALLENGES AND RESPONSES**

The afternoon session focused on cross-sectoral activities and efforts to integrate GRFA in climate change activities at different levels. This session was also moderated by Toby Hodgkin.

**GLOBAL ACTIVITIES:** Peter Holmgren, FAO, presented on the international landscape for addressing climate change and food security, noting the need to consider impacts on human security. He said the long-term goals of achieving food security and avoiding dangerous climate change require sustainable increases in agricultural production, while also increasing greenhouse gas removals through agriculture. Holmgren then described the global policy landscape as a range of issue “mountains” addressed through isolated institutions that measure success in different currencies, while ignoring the interlinkages between issues. To address interlinkages, he called for multi-objective policies that use common measurements for success and avoid micromanagement through detailed agreements. As an example, he presented FAO’s programme on “climate smart agriculture.” He said that while food security is at the heart of the programme, it also addresses climate change in relation to its objectives. In response to questions, he clarified that FAO should not engage in action on human security, but be aware of the link between food security and human security, and that early action could foster political momentum, as well as fundraising opportunities.

Vincent Gitz, FAO, gave an overview of the work of the High-level Panel of Experts on Food Security and Nutrition (HLPE) of the UN Committee on World Food Security (CFS). He depicted food security as situated “in the eye of the storm” of overlapping local, regional and international agendas, including climate change. After describing the HLPE’s assessment process, he outlined the elements of a proposed study on climate change and food security, which would: assess direct and indirect impacts of climate change on food security; identify particularly vulnerable regions and populations; address adaptation and mitigation options; and make recommendations in different policy fields, including options towards a more integrated response and institutional linkages. Gitz then described the institutional layout of FAO and UN Framework Convention on Climate Change (UNFCCC) and suggested that food security be integrated into the work programmes of the subsidiary bodies of the UNFCCC, including those on loss and damage, the Nairobi Work Programme on Vulnerability and Adaptation, and a potential work programme on mitigation in agriculture. Responding to a comment on the lack of attention to livestock, Gitz confirmed that this issue would be taken up by the HLPE.

**NATIONAL ACTIVITIES:** Hari Dahal Ministry of Agriculture and Cooperatives, Nepal, presented on the National Adaptation Program of Actions to climate change and agro-biodiversity Management in Nepal. He described the development of his country’s NAPA, which provides a strategic response to climate change challenges, including nine adaptation priorities. Among priorities he highlighted, *inter alia*: the need to establish a database system and communication network; *in situ* and *ex situ* conservation; enhancement of the legal framework; and capacity development, including among farmers and other local actors.

**COMMUNITY LEVEL ACTIVITIES:** Ximena Cadima, Foundation for the Promotion and Investigation of Andean Products, Bolivia, presented on the role of agro-biodiversity in coping with climate change and the experience of rural communities and indigenous peoples. Based on 200 case studies, she underscored that adaptation measures involve different activities at the ecosystem, agriculture and biodiversity levels and that local and indigenous communities tend to use both traditional crop varieties and new materials. She underscored that local communities need to, *inter alia*, rescue old and traditional crop varieties, and gather crop varieties from other communities that are more resistant to diseases, good for commercial production and adapt to difficult climatic conditions. Among other recommendations, she suggested the: enhancement of farmer and community access to gene banks; development of agreed procedures for seed multiplication and increased technical support to farmers on seed development; and use of the genetic resources.

On the suggestion of farmers’ direct access to gene banks, one participant noted that the gene banks were designed to avoid biodiversity erosion and have few samples of seeds while providing access to farmers for production requires larger quantities of seed. He suggested that intermediate institutions could create and provide these resources to farmers. Other participants recommended the creation of communal gene banks that would allow access to local communities. Many participants from developing countries underlined the need to enhance local and regional capacities for moving ahead on the characterization of genetic resources in the existing regional gene banks.

**DISCUSSION:** Referring to Holmgren’s image of the international policy landscape as isolated mountains, moderator Hodgkin invited participants to introduce their visions on how the international, national and local dimensions could be better connected to tackle climate-change related challenges. Dahal suggested strengthening capacities at the country level,

whereas another participant suggested addressing the response at the very top level to ensure a clear signal is provided. Others suggested that further coordination efforts should be made at the international level led by the FAO or the Commission.

One participant cautioned against simplistic solutions and said climate change requires urgent responses, questioning whether coordinating efforts would be possible in view of time constraints. Other participants called for more coordination at the national level, among ministries and agencies. Holmgren suggested tapping into existing institutions instead of new ones. Cadima highlighted that institutions, policies and politicians are far away from communities’ needs and suggested that focus be retained on making technology available to local communities. Gitz added that solutions can be found on the ground, while Dahal stressed the need to enable farmers to use their agricultural biodiversity through technology and resource transfer.

Hodgkin then invited panelists and participants to reflect on their experience in integrating agricultural biodiversity in NAPAs. Dahal reported the need for better coordination between the ministries of forestry and agriculture in Nepal to ensure that agrobiodiversity concerns are reflected. A participant from India suggested adopting regional approaches to plant genetic resource management to ensure accessibility between countries with similar conditions and shared gene pools, in particular for emergency situations.

Other participants stressed the need to build capacity and human resources for evaluation, characterization and breeding, as well as breeding stations to improve usability of plant genetic resources. Several supported the suggestion to establish seed banks and other mechanisms that provide farmers access to genetic resources that can be used in their fields, in particular for emergency situations. One participant proposed national integration points to ensure that NAPAs consider the linkages with agriculture.

**CONCLUSIONS AND CLOSING:** In summarizing the day’s discussions, Hodgkin said the morning session had shown that there is increasing acceptance of the ecosystem approach and the concept of ecosystem services in addressing linkages with climate change. Other messages included the: importance of accessibility of genetic resources and availability of information, especially in developing countries; different roles of *in situ* and *ex situ* conservation in addressing risks and enabling responses; need for an inter-sectoral approach to adaptation and mitigation; and recognition that climate change leads to the movement of agricultural biodiversity and creates a need for informed decisions of deliberate movements of germplasm.

The key messages from the afternoon session were: while climate change is being embedded in many agricultural strategies and plans, agriculture still needs to be embedded in climate change measures; there is a need for institutions and mechanisms to supply seeds to users; and there is a great need for capacity building activities for adaptation, such as evaluation and characterization.

Chair Mozafari added that participants had recognized the need: for the agriculture community to take action to ensure that GRFA are properly reflected in climate change efforts; to improve the knowledge base, in particular national knowledge on wild crop relatives and wild species; to reconcile efforts in all aspects of food security to ensure coherence; for global partnerships in research, evaluation and characterization; to prioritize the needs of the most vulnerable; and for financial resources. He suggested that CGRFA 13 reflect on how to communicate these needs to the UNFCCC and other instruments to put GRFA on the global climate change agenda. He then thanked participants for their contribution and closed the meeting at 6pm.