Mitigation and adaptation to the impact of natural disasters and climate change on rural food and livelihood security

Background information for FAO-NEDAC Regional Workshop on the Role of Agricultural Cooperatives in Response to the Impact of Natural Disasters and Climate Change

New Delhi, 6 – 8 May, 2008

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FAO Expert Meetings in preparation for
"HIGH LEVEL CONFERENCE ON WORLD FOOD SECURITY: THE CHALLENGES OF CLIMATE CHANGE AND BIOENERGY", 3-5 JUNE, 2008

http://www.fao.org/foodclimate/expert.html

1. FAO Expert Workshop on Climate Change and Biodiversity for Food and Agriculture

FAO Headquarters, Rome, 13-14 February 2008

Options for Decision Makers

Developing the knowledge basis to monitor biodiversity trends and associated risks

Analyzing whether climate change may constitute a threat for biodiversity in the future requires understanding the extent and distribution of biodiversity for food and agriculture, and its vulnerability and adaptation patterns. Matching this information with that available from climate change models will be a basic requirement to inform conservation and adaptation strategies. Lack of characterization and evaluation of genetic resources for food and agriculture will be an obstacle in developing adaptation mechanisms to climate change.

Evaluation is currently an important bottleneck across all types of genetic resources. Improving information systems for genetic resources and the dissemination of relevant information to users will be an important priority for the future.

Suggestions for future action:

• Improve biodiversity national inventories to include relevant spatial information assessing threats caused by climate change to species, populations or genotypes of relevance to food and agriculture.

• Improve knowledge on the genetic processes, such as geneflow, introgression, local populations and extinctions, that allow or undermine species adaptation to climate change of relevant biodiversity for food and agriculture.

• Undertake predictive modelling of future distribution of genetic resources for food and agriculture under different climate change scenarios to inform national strategies.

• Develop biodiversity monitoring plans to analyze changes in delivery of ecosystem services due to climate change in specific farming systems, to inform place-based adaptation strategies.

• Strengthen characterization and evaluation of genetic resources for food and agriculture as a fundamental basis to enable sustainable use.

• Develop or strengthen information systems on genetic resources, including early warning systems.

Mainstreaming: inter-sectorial cooperation and integrated planning

Biodiversity for food and agriculture and climate change have rarely been discussed in the same context. Previous global assessments on climate change have dealt with possible impacts on food security and on biodiversity, but, so far, there has been no comprehensive analysis at the global level of the threats posed by climate change to the biodiversity most important to food security and on the crucial role biodiversity for food and agriculture can play to respond to climate

change. On the other hand, previous global assessments of the status and trends of biodiversity for food and agriculture had limited focus on climate change.

Given its potential to contribute to coping with climate change, the sustainable management of biodiversity for food and agriculture should be made a basic component of adaptation strategies.

Suggestions for future action:

• Improve cooperation between the United Nations Framework Convention on Climate Change and relevant biodiversity forums, such as the Commission on Genetic Resources for Food and Agriculture, the International Treaty on Plant Genetic Resources for Food and Agriculture and the Convention on Biological Diversity.

• Integrate climate change dimensions into future global assessments on biodiversity for food and agriculture, so that the findings can inform future climate change assessments by incorporating agricultural biodiversity perspectives.

• Develop integrated strategies to tackle climate change adaptation and mitigation, food security and rural development, and the sustainable management of biodiversity. In doing so, identify opportunities to deliver these triple dividends, but also the trade-offs and conflicts and ways to resolve them.

Building adaptive capacity through biodiversity management in farming systems

Improving our understanding of the ecosystem services provided by agricultural biodiversity and of how these may be affected by climate change will be a key element in the development of place-based sustainable agricultural responses to climate change. Responses will need to be dynamic given the complex changes occurring at different scales, as explained above.

Smallholder and subsistence farmers or pastoralists are likely to suffer complex, localized impacts of climate change. These vulnerable communities are among those most dependent on biodiversity and on the provision of ecosystem services to guarantee their livelihoods and well-being. Farmers and local and indigenous communities adapt to change continuously, and agricultural biodiversity, especially crop and livestock diversity, has traditionally formed an important element of farmer risk management strategies. Strengthening farmer adaptation strategies, their ecological knowledge and local institutions will enable development of more effective adaptation strategies to climate change. It will also allow farmers and rural communities to play a role in climate change discussions and policy. Developing local response strategies will depend on the complementary knowledge of farmers and researchers.

Suggestions for future action:

• Identify which agro-ecosystems, components or properties of agricultural biodiversity are most or least sensitive to climatic variability.

• Downscale climate change data to allow informed decisions on biodiversity planning by farmers and rural communities.

• Put in place long-term monitoring of functional agricultural biodiversity in production systems and identify key biodiversity indicators to facilitate such monitoring.

- Promote local institutions to manage agricultural biodiversity and strengthen community capacity to access genetic resources and associated information to cope with climate change.

- Strengthen the dissemination of knowledge, appropriate technologies and tools to improve management practices related to agricultural biodiversity and ecosystem services.

Developing climate-change informed plans and policies for genetic resources for food and agriculture

Very few national and international programmes on genetic resources for food and agriculture factor climate change into their conservation and sustainable use strategies. Lack of information is currently an obstacle, but available data suggest that there are serious challenges to confront, as climate change is likely to cause a significant and irreversible loss of the genetic diversity that is critical for the sustainability of the food and agriculture sector.

Both ex situ and in situ conservation will need further support to guarantee the availability of genetic diversity needed for future generations to adapt to climate change. In situ and on-farm conservation measures will need to guarantee the dynamic evolution of genetic diversity to changing conditions. However, there will be regions and species for which the rate of change caused by climate change may be greater than the natural capacity of certain species and populations to adapt or move, and human intervention will be needed to prevent accelerated genetic erosion, in particular through ex situ conservation. However, ex situ conservation should be considered a complementary strategy to in situ conservation, and not substitute for it. The challenge is how to develop an overall integrated approach to conservation and use which will be cost-effective and, at the same time, safeguard as much diversity for the future as possible throughout climate change.

The sustainable use of genetic resources for food and agriculture is the foundation for many of the climate-change adaptation strategies required in food and agriculture. Farmers and rural communities will require genotypes adapted to multiple new stresses, from drought to new pests and diseases. On-farm management of genetic diversity has traditionally allowed farmers to cope with adversity. Breeding is a long-term process, so preparing to adapt to climate change requires planning. Given that climate change will increase the frequency of extreme climate events, measures should be taken to rehabilitate agricultural systems with locally adapted genotypes after disasters.

With climate change, countries will increasingly depend on genetic resources from other countries and regions to adapt their food and agriculture. Loss of genetic diversity at a given place may have negative effects globally as well as locally, as important traits for climate change adaptation may be lost forever. Interdependence between countries with regard to genetic resources for food and agriculture will increase, as will the need to improve the exchange mechanisms for this critical resource. In developing countries, lack of human and financial resources will impede response to climate change through the conservation and sustainable use of genetic resources for food and agriculture. International cooperation, therefore, will be a key element of a long-term strategy to confront climate change in this field.

Suggestions for future action:

• Analyze the effects of climate change, in particular in centres of origin and diversification of genetic resources of relevance to food and agriculture, to inform national conservation strategies.

• Improve monitoring methods of genetic resources being managed in situ, to increase understanding of threats and vulnerability due to climate change.

• Promote the collection and ex situ conservation of genetic resources for food and agriculture most threatened by climate change, and most potentially useful in adaptation.

• Develop robust programmes and strategies for sustainable use of genetic resources for food and agriculture, so that breeders, farmers and rural communities can have available a wide range of genetic diversity to adapt to climate change.

• Support farmers to continue developing locally adapted genotypes through on-farm management.

• Improve rehabilitation strategies after climate-change related disasters to ensure that locally adapted genotypes are re-introduced.

• Integrate climate change dimensions into the relevant international policies and programmes for the conservation and sustainable use of genetic resources for food and agriculture, and the fair and equitable sharing of the benefits arising out of their use.

• Strengthen international cooperation to build capacities in developing countries to conserve and sustainably use genetic resources for food and agriculture to respond to climate change.

2. FAO Expert Meeting on "Bioenergy Policy, Markets and Trade and Food Security and Global Perspectives on Fuel and Food Security"

FAO Headquarters, Rome, 18-20 February 2008

Key Messages*

Bioenergy is here to stay, and it can be part of the transition to a future bioeconomy with low greenhouse gas emissions in which agriculture produces an increasing range of energy and other non-food products. Biofuels may help in the transition to a new equilibrium of production and consumption, and the rapid expansion of the global biofuels industry is a driver of agricultural growth that can create opportunities for a growing rural economy.

Furthermore, biofuels can create opportunities for greenhouse gas mitigation, if properly implemented. But these opportunities also involve challenges in achieving sustainability in terms of environmental concerns and food security, and there are an increasing number of questions over their effects. Policies are currently driven primarily by national and domestic agendas, but the global implications are unclear. This creates the urgent need for a more coherent set of policy principles and approaches. These principles, and the degree to which current policies are consistent with them, suggest the need for a more careful assessment of policy incentives and directions.

The following 12 key messages/points for action are ranked in declining order of priority and are proposed to Ministers for urgent consideration in their policy development and action:

• Impacts of current biofuel policies are not fully understood and there is an urgent need for further analysis, e.g. of land use change, investment patterns, GHG emissions, trade flows and food security.

• There is a need for integration and coherence of policies, between national and global levels and between public and private sectors, to avoid policy instruments that have the potential to create undesirable and conflicting outcomes.

• There is a need for a common methodology for life cycle analysis of GHG emissions, recognizing the importance of emissions from direct and indirect land use change.

• There is an urgent need for internationally-agreed standards to address globally-important environmental implications of bioenergy production.

• There is a need for guidelines for developing and developed countries on estimation and reporting of GHGs, WTO rules, and avoidance of trade barriers (accidental or deliberate).

• There is a need for policies for food and fuel to be linked so as not to compromise food security nor to deprive poor farmers of potential gains from biofuels development.

* A preliminary list of key messages was drawn from the discussion during the combined expert meeting and prioritized by the participating experts. The top ten messages were highlighted and discussed further, resulting in 12 key messages that were agreed by the participants. These were then grouped under a preamble along with four guiding principles proposed by one of the rapporteurs and agreed after revision by the participants.

• There is a need for expansion of the knowledge base, which includes better analysis of data sets available, linking and integration of aggregated and disaggregated models.

• There is a need for issues of certification, compliance and the cost of their application to be characterised, especially for developing countries, recognizing differences in priorities and levels of development.

• There is a need to consider biofuels in the context of the total energy mix, including other renewable energy sources and energy efficiency.

• There is a need for policymakers to provide for the integration of local, regional or international policies that affect the agricultural sector and the rural economy.

• There is a need to develop policies to guide investments in food and/or biofuel in a coherent manner within the context of overall agriculture and food security policies, considering differences in national needs and contexts.

• There is a need to develop policies to assist those adversely affected by climate change and the expansion of biofuels and their impacts. It was further agreed that possible policy approaches could be guided by the following four interdependent principles:

• Outward looking and market oriented: There is a need for policies to be more market-oriented and outward-looking to reduce existing distortions in biofuels and agricultural markets and avoid introducing new ones.

• Environmentally sustainable: There is a need for policies to strive to make biofuels sufficiently ‘net CO2 positive’, protect land and water resources from depletion and environmental damage, and prevent excessive new loadings of pollutants.

• Growth-enabling: There is a need for policies to promote R&D with the objectives of improving economic and physical efficiencies of the feedstock production and befoul conversion processes and adaptation to climate change.

• Protective of the poor and the food insecure: There is a need for priority to be given to the problems created by food deficits and dependence on oil imports for the poor and hungry. Potential opportunities to improve food security and the rural economy from current developments should not be overlooked.

3. FAO Expert Meeting on Climate Change, Water and Food Security

FAO Headquarters, Rome, 26-28 February 2008

Options for Decision Makers

Summary

Climate change is expected to alter hydrological regimes and the patterns of freshwater resources availability with impacts on rainfed and irrigated agriculture, livestock, inland fisheries and aquaculture. By 2060, projections converge in indicating a general reduction of precipitation in semi-arid areas, higher variability in rainfall distribution, increase in the frequency of extreme events (droughts and foods) and increase in temperature, affecting, in particular, agriculture in low latitudes. A significant reduction in river basin runoff and aquifer recharge can be expected to occur in the entire Mediterranean basin, and the semi-arid areas of Southern Africa, Australia and part of the American continent. On the other hand, northern temperate latitudes, in which rainfed agriculture is dominant, can expect positive moisture and temperature impacts to boost overall production. Parts of South East Asia can anticipate increases in run-off which may allow increased water use, but also exacerbate drainage and water-logging problems.

Globally, agricultural production will have to cope with more variability in water inputs and more competition for bulk water with other drivers1 affecting water supply and demand for agriculture. While climate change does not seem to threaten the overall global food balance over the medium term, food insecure areas dominated by rainfall agriculture (Sub-Saharan Africa and Peninsular India in particular) may have multiple short-term adverse impacts, especially in densely populated farming systems, including reduced production levels, lower agricultural incomes, loss of livelihoods and displacement. It is also anticipated that a combination of reduced river base-flows, flooding and sea-level rise will hit highly productive irrigated systems which currently help maintain the stability of global cereal production. The production risks will be amplified in alluvial plains dependant upon glacier melt (Punjab, Colorado) and in lowland deltas in particular (Indus, Nile, and Ganges).

Pressure exerted on the natural resource base underlying food production is already stretched and many of the large contiguous irrigated areas are operating at their socio-managerial limits. Any further change will exacerbate already existing water scarcity problems. At regional and national level this will call for efforts to rapidly increase water productivity and strengthen resilience in all water dependant food production systems. A careful review of soils, surface and groundwater storages and an anticipation of future needs will be key in building resilience and reconciling competing demands while also maintaining environmental services.

1 Other drivers adversely affecting water availability for food production include rapidly increasing nonagricultural water demand for domestic, industrial, and increasingly environmental uses; declining water quality levels; and growing demand for water for non-food agricultural production.

2 Reduced food production capacity in rainfed systems will transmit demand into already tight global commodity markets, driving prices higher and less stable, and putting further pressure on irrigated production. Adaptation strategies focusing on improved water infiltration, soil moisture retention and management, water harvesting, supplemental irrigation, and small- and dam-based irrigation development will be required to increase the resilience of these highly vulnerable production systems. One critical water-related action is to promote technical and management measures to reduce non-beneficial consumptive use in both irrigated and rainfed production systems. Another is to support extension-services to promote diversification into crops with higher water productivity to adapt to changing markets. Also relevant is the update of land and water management development strategies to take account of anticipated climate change impacts.

The knowledge base is sufficiently precise to warrant mainstreaming now. Notwithstanding gaps in data and research, progressive adaptation across land and water systems are justified on a 'no-regrets' basis2. To do this, specific national capacity in climate change assessment will be required. System-based analyses and plans, operating within an integrated water resource management framework, will have to be married with enhanced analysis of particular crops (e.g., food staples as wheat and rice) and ecological regions. At all levels, adaptation and mitigation programs need to start with an awareness building initiative among policy makers, researchers, and opinion leaders focusing on production systems most threatened by climate change impacts. Regional centers on water, climate change, and food, linked to existing national and international centers of excellence are recommended to support national capacity in copying with climate change.

Additional and new financing mechanisms for adaptive water management initiatives will be needed. Farmers access to micro-credit has show to be a positive adaptive strategy. Capacity building must be an integral part of these programs. Priorities at national, regional and international levels Given the instrumental value of water to all economic sectors, agriculture cannot act alone. Water management actions will need to be focused at national level but supported by regional and international initiatives. Specific recommendations are;

National level

Planning approaches

- Provide support at the national level for collection of data and information for assessing renewable water resources and study the impact of climate variability and potential change on it

- Mainstream adaptation and mitigation measures for agricultural water management into national development plans employing an integrated water resource management (IWRM) framework

- Adopt strategic inter-sectoral development planning to increase resilience and adapt to climate change impacts and maintain environmental services/biodiversity

- Actions that result in positive adaptation response to climate change and that also make good environmental and economic sense in their own right

- Update land and water management development strategies and economic plans to account for anticipated impacts of climate change, particularly the amplification of variability and long term drying/wetting trends

Institutional development

- Set the conditions for more flexible and responsive service oriented water management

- Develop tools for water-related conflict resolution and prevention at local and district level

- Develop and implement economic/financial trade instruments to remove distortion in water allocation

Management options

- Revise operating procedures for water storage systems to accommodate climate change impacts on water supply and demand

- Promote watershed management and soil moisture conservation practices to increase infiltration and soil water storage

- Increase surface and groundwater storage options at a range of scales including distributed tank rehabilitation and possible new large scale impoundments

- Increase water productivity by a variety of measures (e.g., intermittent irrigation of rice)

- Promote risk management in national policies through better monitoring networks, risk assessment, early warning, risk sharing and participatory response mechanisms

- Develop alternative sources of water supply, such as treated wastewater streams for peri-urban agriculture and desalination plants for coastal urban supply

Economic and financial instruments

- Document and quantify current patterns of water use and water entitlements

- Develop transparent water allocation mechanisms to protect water use rights while providing greater flexibility to respond to scarcity under anticipated patterns of climate change

- Innovative insurances products

Regional level

- Develop and strengthen transboundary cooperation and institutional mechanisms to anticipate and respond to climate change impacts on transboundary water resources, including mechanisms to optimize water allocation and manage extreme hydrological events (floods and droughts)

- Standardize climate and hydrological data formats and promote exchange of national data to improve operational hydrological forecasting and regional climate prediction/forecasting

International level

- Marry global data sets on water resource balances at basin level with production data to track climate change impacts.

- Focus international research agendas on systemic water productivity gains

- Promote interlinkage between climate change, water and food security needs in global water meetings such as the World Water Forum.

- Assess the vulnerability of globally-important food production systems and related potential impact on food security for the low-income food-deficit countries.

Addressing Knowledge Gaps

There are key gaps in data and research related to climate change and water. Many of these have been stipulated in IPCC AR4 and the forthcoming Technical Paper on Climate Change and Water. In view of these reports, it is recommended that policy makers are aware of current shortcomings and gaps in data and applied research

The Data Problem

Quality-assured local and country data are essential to establish overall water supply and demand balances, track climate change impacts and inform responses. Improved national data collection and verification are widespread needs, requiring international support and coordination. Internationally recognized databases such as AQUASTAT and FAOSTAT are important vehicles

for regularizing, organizing, and disseminating improved national and basin-level water data. Key areas requiring attention include

• Improved water water supply and water use data, considering both quantity and quality
• Improved data on the frequency and magnitude of extreme events
• Improved estimates of exploitable groundwater reserves

Information on water resource status needs to be accompanied by enhanced information on water use in all water-using sectors and on the value and productivity of water in the various agricultural sub-sectors. The latter would include rainfed and irrigated agriculture, fisheries, agro-forestry, and livestock and would assess competition, complementarities, and relative contributions to food security.

Water management, agriculture and food security databases should be better integrated, with much closer monitoring of irrigated and rainfed production and clearer distinction between the sources of supply (rainfall, surface water, and groundwater). This effort should consider specific food staples, notably rice and wheat, as well as the productivity of water dependent aquatic environments.

The Research Agenda

A priority for applied research will be integrated assessments of the impact of climate variability and climate change on food security. These analyses would underpin development of enhanced adaptation methodologies and strategies and should include assessment of the potential impact of bioenergy production and mitigation measures such as minimum-tillage and agro-forestry development on water resources.

Important factors to consider in impact modeling include climate variability, shifts in seasonality, land use changes, yield responses to temperature rise and increased CO2 concentrations, new crop varieties, and the impact of trade and macro-economic and sectoral policies.

Specific research issues recommended are:

• potential water productivity increases in crop agricultural, taking into account local production environments, livelihood impacts, technological options, and environmental impacts.

• methods for improving linkages between remote sensing information and ground-based data.

• downscaling climate projections for use in hydrologic modeling and agricultural water management.

• assessment of the potential impact of bioenergy and other mitigation measures on water availability for food production

• social, economic, institutional, and human resource limitations to adaptive capacity and strategies for easing these constraints.

Addressing Capacity Needs

Because proactive policy and action responses are typically taken at the national level, the capacity of national systems to generate knowledge, inform decision making, build awareness, transfer knowledge and implement effective action is critical to successful adaptation to climate change.

These immediate steps are recommended:

• Promote technical and management measures to reduce non-beneficial consumptive use in both irrigated and rainfed production systems and support extension services to promote diversification out of main water using crop systems into crops with higher water productivity.

• Build specific skills at the national level in economic planning, demand forecasting, model downscaling, and hydrologic impact assessment to supplement current analytical capacities.

• Create or strengthen regional centers on water, climate change, and food, linking to existing national and international centers of excellence to build local and regional capacity. Key objectives of the centers would be to produce scaleable solutions to food production under amplified hydrological variability and temperature changes and to support the update land and water management development strategies to account for anticipated impacts of climate change. Their tasks include data nalaysis, research, education, training, policy support, communication.

Enabling financial mechanisms

Given the technical options identified above, the investment space for agricultural water management can be opened up. Specific recommendations are:

• Mobilize adaptation funds to support developing countries investments to build analytical and management capacity to meet the challenges of water and food security under CC

• Fund national adaptation programmes of action (NAPAs) in LDCs to accelerate adaptation in agricultural water management.

• Encouage national governments to allocate adequate financial resources for adaptation planning in the field of water management for agriculture.

• Enhance opportunities for small farmers to develop CDM projects and access funds in post-2012 arrangements.

• Enable adaptation/mitigation financing mechanisms to best practices, such as alternate wet-dry rice production systems

4. FAO Expert Meeting on Climate Change and Disaster Risk Management

Rome 28-29 February 2008

Policy Brief: Options for Decision Makers

1. KEY POLICY CHALLENGE ADDRESSED BY THE EXPERT MEETING

Climate variability will result in more frequent and extensive disasters – with the most severe consequences on the food security and livelihoods of agriculture-dependent populations in vulnerable countries. Changing climate patterns have increased the urgency to invest in disaster risk reduction, preparedness and management activities, above and beyond other efforts directed toward climate mitigation and adaptation.

The expert meeting considered cross-sectoral linkages between climate change and disaster risk reduction and management, with a particular focus on the implications for agriculture and food security. The scope of the expert meeting concentrated on those aspects of climate change related to increasing frequency and intensity of extreme climate events such as droughts, floods, wind storms and wild fires. The meeting did not address projected longer term impacts of gradual climate changes such as melting of glaciers, sea level rise and ecosystem stress.

2. CONTEXT

Climate-related disasters are increasing. The number of reported disasters related to hydro-meteorological hazards (droughts, floods, wind storms, forest fires or landslides) significantly increased from 1987 to 2006 - from an average of 195 per year from 1987 to 1998 to an average of 365 per year from 2000 to 2006 . In the period between 2000 and 2007 of the more than 230 million people affected annually by disasters about 98% were due to weather and climate related hazards, predominantly by floods and windstorms, followed by droughts .

Climate change is altering disaster risk patterns in three primary ways, according to the Inter-governmental Panel on Climate Change:

- increase in the frequency and intensity of extreme events, such as more frequent extreme temperatures and heavy precipitation, more intense tropical cyclones, larger areas affected by drought and floods;
- changes in geographical distribution of areas affected by hazards; and
- increase in vulnerability of particular social groups and economic sectors due to sea level rise, ecosystem stress and glacier melt.

However hazardous events do not in themselves determine disasters, which also depend on human vulnerability. Disaster hotspots are characterized by exposure to recurrent hazards combined with high numbers of people living in vulnerable conditions. Negative impacts on food and livelihood security will not be due to the increase of climate hazardous events alone but to the cumulative effects of multiple shocks (e.g. climate, market, and health) combined with governance issues, socio-economic factors and environmental degradation. Mortality risk due to climatic hazards is highly correlated to low levels of human development and large rural populations, indicating that economic and social development is a key element of risk reduction. The poorest developing countries are particularly vulnerable to climate risk because of their geographic exposure, low incomes and greater reliance on climate sensitive sectors, particularly agriculture. Over 98 percent of the 262 million people affected annually by climate disasters between 2000 and 2004 live in developing countries , and the vast majority depend mainly on agriculture for their livelihoods.

Although hazards are increasing, capacities to cope with disaster risk have improved. Disaster occurrence in the past thirty years has increased much faster than the numbers of deaths, which have remained relatively constant . Thus pro-active strategies are essential if vulnerable countries are to avoid large-scale loss of life and destruction of the environment and infrastructure, as well as deterioration of food security, livelihoods and nutrition.

3. DEVELOPING THE KNOWLEDGE BASIS

The potential linkages between evolving disaster risk patterns and the likely impacts of climate change are complex, non-linear and only partially explored.

The available instruments to explain global trends and advocate for global action are not detailed enough to inform national planning and policy making. Downscaling of climate models (focusing on projected changes) combined with local level vulnerability assessments (focusing on current threats) is necessary to improve understanding of local and national risk profiles and advance risk reduction and response planning. Only such integrated assessments will allow for improved understanding of who is vulnerable and how vulnerability patterns will change over time. Analysis needs to be conducted through the use of disaggregated data that differentiates levels of vulnerability according to age, gender, social and poverty groups, ethnicity and other socio-economic factors that influence people's resilience.

Climate change is happening together with rapid changes in the global economy, communications and social support structures, which generate additional threats and opportunities for climate risk reduction and response.. To date the focus has been mainly on the analysis of the impacts on food production, however, more focused attention on the complex interactions between these factors is necessary to understand the present and longer term impacts on livelihoods and food access, stability and use.

A number of tools have been developed within the humanitarian community to measure (quantitatively and qualitatively) the impact of disasters on food security and livelihoods. Baseline livelihoods profiling and analysis and food security assessments in areas at high risk are useful to understand post-disaster needs, measure progress in adaptation and risk reduction, and ensure that development programming takes into consideration the needs of the most vulnerable groups. This should be combined with improvements in statistical disaster data collection and analysis at country level.

Most of the adverse impacts of future climate risk will be an intensification of current hazards in places where they already occur as well as an extension to new areas. As most countries and communities have adapted to climate variability over centuries, capacities developed to cope with existing climate threats can be used for adapting to future threats. There is a need to learn more about current coping strategies and for science-based research to address current threats .

4. MAINSTREAMING: POLICY AND IMPLEMENTATION FRAMEWORKS AT NATIONAL, REGIONAL AND INTERNATIONAL LEVELS

4.1 Climate change and disaster risk management are closely linked

Disaster risk management and climate change adaptation are ultimately about reducing the risk posed by climate change to the lives and livelihoods of vulnerable people and therefore are key tools for protection of food security.

There are two major linkages between climate change and disaster risk management: first, climate change will increase the number and scale of disasters that need to be managed and modifies local vulnerability to shocks; and second, existing institutional structures, technologies and tools to manage disaster risk are natural entry points for reducing losses to current threats and thereby enabling longer term adaptation

Two distinct communities of practice have evolved with regard to reducing vulnerability to climate risks: one is focused mainly on longer term global climate change research and modelling, and the other on national and local level management of hazards and disasters. Disconnection between these two communities (conceptual frameworks, institutional frameworks and funding approaches) has often resulted in local level failure to reduce vulnerability. However efforts to bring together the two communities are emerging and to a great extent informed by the principle of addressing vulnerability to existing shocks while developing sufficient flexibility to adjust to uncertain future scenarios (i.e. tackling gradual changes and new hazards).

4.2 Climate change and disaster risk management need to be integrated into development planning and humanitarian assistance

Climate related disasters can reverse development gains by undermining livelihood and food security, damaging infrastructure, increasing exposure to disease and eroding ecosystems. At the same time, unsustainable development augments climate risk through increases in green house gas emissions and exacerbating physical and socio-economic factors of vulnerability (e.g. unregulated urbanization, natural resource degradation, and unequal access to information). There is general agreement that disaster risk management and climate change should be embedded in development and relief planning to avoid that risk accumulates through inappropriate development and to ensure that structural factors of vulnerability are systematically addressed.

This said, no matter how much is invested in risk reduction, poor and marginalized people with limited assets will fall back on humanitarian assistance, therefore there will be increasing demand for national and international emergency response. Climate change will have major implications for humanitarian approaches, logistics (i.e. management of an increasing number of smaller scale disasters simultaneously and of “mega-disasters”) and financing (in particular, a need for more flexibility to allow for support to local and national emergency systems, investment in preparedness and enhanced linkages with development activities).

4.3 Implications for mainstreaming at different levels

4.3.1 Local level

Local institutions are the backbone of disaster risk management and will be the primary interface for community level efforts in adaptation to climate change. Risk reduction and response occurs primarily at the local level , however capacities to absorb new skills and technology are limited and local institutions tend to suffer from donor driven “mainstreaming fatigue”. Support for improved understanding and management of climate risk needs to be channelled through existing formal and informal institutions (such as churches, extension services, health points) and programmes (food security, water and sanitation, rural development) taking into consideration that communities normally address climate risk through a multi-hazard perspective focusing on immediate threats. Extension services can play a key role potentially in delivering advisory services for climate risk reduction but this requires enhanced collaboration with national research institutes and regional/international organizations and training of staff. Most disaster risk management functions benefit from devolution of responsibilities (following the principle of subsidiarity), ideally allowing for a combination of both “top-down” and “bottom-up” approaches..

4.3.2 National level

To take into consideration evolving climate risks and particularly their likely impacts on agriculture, fisheries, forestry and food security issues, enhanced collaboration is needed between disaster risk management institutions (normally housed within the ministries of interior and/or civil protection with strong linkages with the international humanitarian community), climate change focal points (normally housed in the ministries of environment and/or meteorological services with

strong linkages to national and international research institutes) and food security focal points and advocacy groups to ensure that food security and livelihoods protection are addressed in climate adaptation and risk management strategies. More specifically this implies that:

- agriculture, environment and food security departments are represented in the disaster risk management committees (national, provincial, local);
- risk reduction/climate change adaptation focal points/teams should be appointed within food security, agriculture, fishery, forestry line departments and trained;
- cross-sectoral/multi-stakeholder platforms are established to identify risk reduction and climate change adaptation priorities and involve research institutions, civil society and the private sector;
- sector-specific (multi-hazard) risk reduction strategies (for example, national strategy for risk reduction in the agriculture sector) and/or cross-sectoral hazard management plans (for example, national/local drought management plan) are developed and implemented; and
- vulnerability assessments are integrated in Poverty Reduction Strategies and national/local development plans .

4.3.3. Regional and international levels

Climate hazards affect communities across national borders. Regional cooperation frameworks are essential to manage transboundary issues . Such frameworks are becoming key instruments to enhance national preparedness and contingency planning capacities.

At the national and international levels, the UN ISDR Hyogo Framework of Action (2005-2015) provides a valuable framework to set priorities for action and serves as a platform to operationalize linkages between disaster risk management, climate change and development.. The post Kyoto negotiations should allow for stronger emphasis on food security and livelihoods protection in the context of climate change adaptation, including through mechanisms to support and fund local level adaptation with additional resources mobilized in recognition of industrialized countries responsibilities.

Climate risk management should also be integrated into international agencies' strategic plans and become a theme for enhanced UN agency collaboration, particularly though the UNDAF processes. FAO should be encouraged to assume a more proactive role in facilitating collaboration between the Rome based UN agencies on issues relating to the agriculture and food sectors and to enhance linkages between research, policy making and local level institutions for climate risk management.

Relevant information on climate risk has often been unavailable, inaccessible, not usable or understandable by end users. More emphasis on networks (national line departments, research institutes, civil society and regional/international organizations) is needed for awareness raising, information sharing and communication is necessary at all levels.

5. PRIORITIES FOR ACTION

a) Systematic national and local risk assessment combining the downscaling of climate models (focusing on projected changes) with local level vulnerability assessments (focusing on current threats, particularly to coastal, riverine and drought prone areas) and developing greater understanding of impacts of climate impacts on food security, access to natural resources, agriculture, fisheries and forestry. This includes:

- a review of climate risk information available at national level and of capacities for data collection and use

- undertaking country wide risk profiling with a focus on vulnerable areas, sectors and groups

b) Integration of risk mitigation and climate change adaptation in climate sensitive sectors. This includes:

- adaptation of agriculture, fisheries and forestry practices (for example: adjustment of crop and fishing calendars, and introduction of climate resilient crop and tree varieties)

- climate proofing of post-harvest management practices (storage, drying, processing)

- improved sustainable natural resource management to increase resilience of food production systems

- afforestation and agroforestry

- investment in infrastructural measures and hazard proofing of critical facilities
- livelihood diversification (less climate sensitive farming activities, small scale enterprise development, off-farm activities).

c) Improved use of climate information. This will require more investment in climate station networks, capacity building for interpreting information, user-friendly forecasting tools and products, linkages between service providers (researchers and hydro-meteorological services and users (humanitarian actors and climate sensitive sectors), and production of impact outlooks for different audiences.

d) Enhanced people centred early warning systems and mechanisms to allow for early alerts to trigger early action. Messages need to take into consideration issues of trust and differences (gender, social, age) in access to information and mobility issues.

e) Strengthen preparedness for effective response. This includes:

- contingency planning (especially in flood/windstorm/drought prone areas) taking into consideration new and evolving risk scenarios and integrating “build back better” principles to induce prevention and adaptation in rehabilitation

- at the international level more flexible funding mechanisms are needed to allow for development and humanitarian resources to be invested also in preparedness

- multiple livelihoods based response options and social protection measures that are supportive of local coping strategies (such as crop insurance, starter packs, seed fairs, cash transfers) .

f) Resources. The high political profile of the current debate on climate change provides opportunities for enhanced political commitment and increased resource allocation to vulnerability reduction. A number of new and traditional funding instruments can be used to address climate risks and consequences of food security ranging from micro-finance tools to support ex ante disaster risk management activities at the community and household levels to adaptation funding through UNFCCC processes and new funding windows for least developed countries such as the World Bank Global Facility for Disaster Reduction and Recovery.

5. FAO Expert Meeting on Climate Change Adaptation and Mitigation

FAO Headquarters, Rome, 5-7 March 2008

Options for Decision Makers

Introduction

Climate change will compound existing food insecurity and vulnerability patterns. Communities must prepare themselves for the possibility of food shortages and make appropriate use of resources to protect their livelihoods as well as lives and property. It is imperative to identify and institutionalize mechanisms that enable the most vulnerable to cope with climate change impacts. This requires collaborative thinking and response to the challenges generated by the interaction between food supply, climate change and sustainable development.

The climate adaptation context

Vulnerability to food insecurity shocks has grown global. Global and local food security vulnerability patterns will be modified by climate change. Small-scale rainfed farming systems, pastoralist systems, inland and coastal fishing and aquaculture communities and forest-based systems are particularly vulnerable to climate change. Moreover, the urban poor, particularly in coastal cities and floodplain settlements, face increasing risks. It is urgent to build "resilient" communities living off agricultural, forestry and fisheries/aquaculture systems that have high capacity to adapt to stress and disturbances.

Attempts to improve resilience to future and uncertain impacts through anticipatory and planned adaptation and innovation will have both immediate and future costs – with trade-offs between optimizing current conditions and minimizing vulnerability to future shocks. For instance, diversifying agriculture may decrease profitability in the short term, but also reduce future vulnerability. Adaptation to climate change must also focus on prevention and removal of maladaptive practices that may do not succeed in reducing vulnerability but, instead, could increase it.

Technical adaptation measures range from temporal and spatial variations in production systems (e.g. adjusting planting or fishing dates, rotations, multiple cropping/species diversification, crop-livestock/pisciculture systems, agroforestry) to confer better protection against temperature changes, changing rainfall variability and patterns, salinization though sea level rise, and pest attacks - to investing in soil, water and biodiversity conservation and development (e.g. building soil biomass, restoring degraded lands, rehabilitating rangelands, harvesting and recycling water, planting trees, developing adapted cultivars and breeds, protecting aquatic ecosystems) in order to maintain long-term productivity.

Adaptation measures also include establishing disaster risk management plans and risk transfer mechanisms, such as crop insurance and diversified livelihood systems. For example, integrated aquaculture-agriculture systems will allow activities to shift in response to changes in the suitability of land and availability of water to produce food. In cases where benefits of diversification are limited, such as those that affect all aspects of the food production systems, social safety nets are required. An important caveat is that there are limits to adaptation. Due to changing climate, the frequency of floods and droughts may increase so much that agriculture, fisheries and forestry are no longer sustainable. Diversification to other economic activities and relocation will need to be considered under such conditions.

Mitigation: new options for carbon sequestration in agriculture and forestry

Agriculture and land-use change such as deforestation contributes to, respectively, 13 and 17 percent of total anthropogenic greenhouse gas (GHG) emissions. While carbon dioxide emissions

from agriculture are small, the sector accounts for about 60 percent of all nitrous oxide (N2O, mainly from fertiliser use) and about 50 percent of methane (CH4, emitted, mainly from natural and cultivated wetlands and enteric fermentation). The GHG impact through radiative forcing of N2O is 300 times that of CO2. Methane and nitrous oxide emissions are projected to further increase by 35 to 60 percent by 2030, driven by growing nitrogen fertilizer use and increased livestock production in response to growing food demand.

Mitigation of climate change is a global responsibility. Agriculture, forestry, fisheries/aquaculture provide, in principle, a significant potential for GHG mitigation. The IPCC estimates that the global technical mitigation potential for agriculture (excluding forestry) will be between 5 500 and 6 000 Mt CO2-equivalent per year by 2030, 89 percent of which are assumed to be from carbon sequestration in soils.

Global Soil Carbon Sequestration Initiative. IPCC estimates that the reduction of agricultural GHG mitigation options are cost-competitive with non-agricultural options for achieving long-term climate objectives. Soil carbon sequestration could in fact take effect very quickly and is very cost-effective in agriculture. A win-win approach could be achieved by paying farmers for carbon sequestration (building soil organic matter) which sets up a scenario where: CO2 is removed from the atmosphere (mitigation); higher organic matter levels in soil increase agroecosystem resilience (adaptation); and improved soil fertility leads to better yields (production and income generation). However, sequestration of CO2 in soils is not included in the Clean Development Mechanism (CDM) agreed to in Kyoto. The scope of the successor of the CDM could be enhanced with a view to increase carbon sinks in soil and in above- and below-ground biomass, and thus contribute to removing methodological barriers to operationalising soil carbon sequestration under the Post-2012 climate change regime. FAO should play a leading role in this process, including through the establishment of a Global Soil Carbon Sequestration Initiative entrusted with the promotion of agricultural technologies that restore carbon pools and soil quality (e.g. organic agriculture, conservation agriculture) and to create tools to measure, monitor and verify soil carbon pools and fluxes of greenhouse gas emissions (namely nitrous oxide) from agricultural soils, including croplands and pastures.
Reducing Emissions from Deforestation and forest Degradation in developing countries (REDD). Since the Eleventh Session of its Conference of Parties (COP) in November 2005, UNFCCC has been exploring the possibility of developing an instrument under the Convention to provide financial incentives for Reducing Emissions from Deforestation and forest Degradation in developing countries (REDD). As the UN agency with the mandate for forestry and a comprehensive programme covering all aspects of forestry as well as agriculture, FAO can play a leading role in: providing technical information and support for the development of methodological and policy options for REDD; strengthening capacity for countries undertaking REDD programmes, including developing systems for monitoring changes in forest carbon; and addressing underlying causes of deforestation and forest degradation rooted in both the agriculture and forest sectors. In addition, FAO can launch a comprehensive REDD support effort for developing countries.

The knowledge base

Strengthening IPCC and UNFCCC on agriculture and food-related issues. IPCC could improve its assessments on the impacts of climate change on food security. The establishment of a Global Food Security Observing System (GFSOS) is seen as an extension of FAO's Global Information and Early Warning System. It is also a technically feasible option to set up permanent monitoring of the effects of current and future climate on food security. Global studies must be complemented by comprehensive national assessments of climate change impacts on agriculture and food security. Local impacts are badly needed to support national and subnational decision-making. While existing studies mainly focus on the effect of downscaled climate change scenarios on major crops and aquatic species, future studies should look at a wider range of crops and also take into account local farming dynamics and resource base, food marketing chains and delivery systems, the greater international connectedness, food prices, the

implications of agricultural policy and possible development pathways. In some regions, such as large parts of Africa, such studies are hampered by highly uncertain trends in rainfall, the insufficient resolution of climate models and the lack of climate observation data.

Improving data collection and impact assessment capacity. Improving data collection and sharing results at national, regional and international levels will improve local weather forecasts, seasonal climate forecasts, risk and impact assessments. It can also increase the detail of climate impact assessments to a scale that is meaningful for optimizing adaptation and mitigation measures, and operating nearly real-time early warning and hotspots warning systems for food security, agriculture, forestry and fisheries. This refers particularly to the 10 to 15 years time horizon over which the reliability of impact projections is probably acceptable and the planning of responses is probably realistic. Better data will improve access to international funding mechanisms. National extension and agronomic research services have an increased role to play in data collection, analysis and use for decision-making and decentralized service delivery to farmers. There is also a need to include social science research to boost understanding on how people adopt and implement adaptation and mitigation options.

Agroecological research. Research will provide the backbone for adaptation and mitigation methodologies. However, research for a rapidly changing situation is different from research for stable ecological conditions. Traditional knowledge and local biodiversity are a suitable entry points, but likely to be insufficient in a rapidly changing situation. In addition, methodologies, crops and crop varieties need to be developed for future conditions as their applicability cannot be assessed at the location where they may be used in future. This requires strong national and international agricultural, forestry and fisheries research and provides an important role to the Consultative Group on International Agricultural Research (CGIAR) Centres. Research results need to be public in an enabling environment in which methods, germplasm, crops/species varieties, animal breeds and crops are accessible for use and introduction in adaptation programmes.

Climate-related capacities in agriculture, forestry and fisheries

Country capacity to assess and apply adaptation and mitigation measures in agriculture, forestry and fisheries is weak at two levels: national institutional frameworks; and adaptive capacity of local populations to climate change and variability. To implement national climate change and food security policies, there is need for in-depth knowledge of appropriate methods and tools as well as awareness of available funding mechanisms, such as the carbon market and adaptation funds established under the IPCC.

Capacity strengthening. The capacity to identify, collect and share data, use information and methods and build knowledge relevant for climate change adaptation, mitigation and food security is critical because of rapidly changing climatic, environmental and socio-economic conditions. Extension services and mechanisms have been weakened greatly over the last two decades. Extension will need to be strengthened substantially in order to address adaptation and mitigation if it will have to provide an efficient interface between policy-makers and the farming community. Recognizing that climate change will alter many existing equilibriums, socio-economic dynamics must be considered, and the role of all the partners may need to be re-examined or redefined.

Capacities weaknesses in adaptation development in the food sectors

• vulnerability of infrastructure (e.g. irrigation, means to cope with flood, seawater incursion protection), non-structural measures (legislation, insurance and capacities to integrate adaptation into development planning at all levels), transportation, food storage and distribution systems to climate vagaries;

• insufficient lack of crop varieties, animal and aquatic species breeds, trees and forests adapted to climate change;

• insufficient lack of climate-related knowledge in research and extension;

• lack of standard tools to assess main vulnerability patterns that can be tailored to national circumstances;

• lack of monitoring and forecasting of variable food availability;

• insufficient knowledge of rural development and of the roles of markets, trade, migration, refugees and urbanization and their linkage to climate change and food security;

• lack of understanding of social dimensions of vulnerability and resilience, such as how climate change will require shifts in use of, and access to, natural resources (land, water), credit and education;

• insufficient institutional capacities and integration.

Regional cooperation. Neighbouring countries often share similar problems and solutions. Countries can pool their resources to inventory and share traditional and innovative solutions. They can also take advantage of developing regionalized markets in order to reduce greenhouse gas emissions and transport costs and increase benefits and rural incomes.

Policy development

Integrated climate change strategies. Climate change strategies and action plans must account for all sectors' specificities. Since food security, sustainable development, and climate change adaptation and mitigation are strongly linked, policies need to be integrated across levels (from people to institutions and ministries) and across sectors. This will avoid later contradictions between local actions and higher decision-making, and ensure that national policies use the benefits associated with the international mechanisms to improve the livelihoods of people.

Awareness raising, permanent monitoring of changing vulnerabilities and capacity building are essential components of national climate change strategies. Increasing resilience of food production systems. Many countries would benefit from identifying and promoting positive incentives to practices, production systems, and land/aquatic resource-use policies and tenure systems that increase resilience of food production systems. Countries should facilitate the design of new policy tools that consider climate change but also build on already available tools such as early warning systems and disaster risk management. In parallel, negative incentives that encourage harmful practices and production systems and unsustainable land/aquatic resource-use should be identified and removed. Policies to encourage appropriate investments and technology transfer into rural areas should be directed towards reducing long-term negative effects of short-term climate variability on food security. Examples include crop insurance, policy, legislation and nonstructural measures that target vulnerable people.

Land and aquatic resource use planning. Investments in forest conservation and sound forest management, tree planting, sustainable fisheries and aquaculture development, and improved soil and water management for climate change mitigation and adaptation require addressing tenure constraints and incentives, and managing pressure and conflicts over resources. It is paramount to secure land and resources rights of groups and individuals, facilitate community involvement and establish solid, robust institutions for governance and conflict resolution.

Land water and aquatic resource-use planning and policy measures are particularly essential to: avoid perverse incentives which lead to detrimental land conversion such as from forest to agriculture; identify measures to reduce pressure on natural resources and promote sustainable land-use systems; avoid encroachment of agriculture and disruption of mobile dryland pastoral

systems that are adapted to droughts and irregular rainfall; and manage the consequences of massive migration and refugees.

Financial instruments

More active participation in the international climate change discussions. Climate variability and change are dominant factors driving food production availability and stability. They also affect, at least indirectly, food accessibility and utilization. Measures aiming at improving food security directly contribute to sustainable development. On the other hand, measures for adapting to climate change or reducing emissions can contribute to food security. The Post-2012 climate change regime that is currently being prepared offers an important window of opportunity to developing countries. Many countries would benefit if the international carbonrelated funding mechanisms paid more attention to food security, agriculture and livestock, soil, fishery and rangeland activities, along the lines of REDD (Reducing Emissions from Deforestation and forest Degradation).

CSO/NGO Consultation for the FAO High Level Conference on World Food Security and the Challenges of Climate Change and Bioenergy
FAO Headquarters, Rome, 15-16 February 2008

Key Messages

A. ***World Food Security and Climate Change***

Agriculture is adversely affected by climate change

1. Agriculture that is responsible for world's food security has been greatly affected negatively by climate change. Agriculture is a victim of climate change.

2. The world's poor are the ones who are most food insecure and the ones who are already most effected by climate change. Their primary interest is food availability, therefore, there is urgent need for FAO to take up the agenda on their behalf or those who are already most affected by climate change.

3. Since food security for those affected by climate change is in danger, FAO should take a pro-active role to develop pro-poor positions on food security and climate change using the Right to Food at the heart of its principle.

4. The climate change impacts, including projections, on producers in areas such as water, forests, fisheries, and plant genetic resources should be documented. FAO's technical role in this regard is important.

5. The voices of the highly marginalised who are mostly vulnerable to climate change and representatives of all social groups including indigenous peoples, women, pastoralists and others should be better kept informed and be engaged with a widest possible participation at the High Level Conference (HLC) process.

6. In ensuring that highly marginalised groups are kept informed, FAO should develop funding mechanisms devoted to promote dialogue with civil society organisatons (CSOs) and social movements starting from the national and regional levels through FAO's decentralised structure as part of the HLC process. This is crucial particularly for member-based organizations in order to respect their internal process of consultation and decision making process, as well as to solicit information going to and coming from their memberships.

Other concerns on the linkage of food security and climate change

7. The potential mitigation effects of climate change on small scale farmers and other producers, fisheries and extensive livestock production, are not necessarily analysed yet due to insufficient information. Likewise, there is lack of information and research on the impact of global trade on climate change and the benefits of more localised trade (documenting the respective impacts of production systems, transport and marketing).

8. Examination of the issues and impact of climate change and bioenergy should be multi-dimensional and gender-differentiated, and focused on sustainable agriculture with a view of attaining of food security. It is crucial for FAO, as a technical agency, to provide a holistic view of food security, climate change and the status of rural livelihoods and to examine government's accountability under the Right to Food Guidelines.

9. FAO's focus should clearly put priority first on food security, not on alternative uses for agricultural production that put food availability at risk for the most vulnerable.

Agriculture is one of the major sectors contributing to GHG emissions

10. The predominant models of industrial agriculture are not sustainable and not viable.

11. Participants also noted different systems of livestock production, emphasizing the viability and benefits of open range production. These benefits include carbon sequestration in grasslands, water replenishment, biodiversity conservation and ecosystem stability and sustainability.

Agriculture and carbon sequestration

12. Farmers and other producers have a lot of knowledge and experience to face climate change. Small-scale farmers and producers can offer solutions to the world's problems of climate change - one participant said they can even help "cool" the planet.

13. There is a need to build on their local knowledge and experiences and stimulate the introduction of appropriate technology and technical options at the local level for smallholders and the resource poor. There should be options for smallholders for mitigation and adaptation building from local experiences. FAO should facilitate exchanges of experiences amongst rural people. This should serve as a basis for researchers and experts, respecting and taking into proper account the accumulated wisdom of rural peoples.

14. The potential of well-managed grasslands for storing and sequestering carbon and water infiltration to both mitigation and adaptation that is based on historical uses and practices provide some background around the balance of emissions and benefits associated with livestock. There is a need to document the roles of pastoralists and the different systems of livestock production, benefits of open range production including carbon sequestration in grasslands, water replenishment, biodiversity conservation and ecosystem stability and sustainability.

15. FAO has a fundamental role in documenting and promoting models of sustainable farming and agricultural practices, the value of the husbanding of ecosystem functions – and not just providing services. Sustainable regulatory frameworks should be at the top of the international agenda, addressing human rights and rights based approaches.

Call for research, information gathering, dissemination and monitoring

16. FAO should play a role in promoting and presenting research on the impact of global trade on climate change and the benefits of more localised trade (documenting the respective impacts of production systems, transport and marketing).

17. Overall processes of concentration of natural resource access worldwide and the impacts on producers as well as the projected impacts for climate change should be documented. These resources include water, forests, fisheries, and plant genetic resources.

18. FAO needs to better transmit information to farmers and rural communities, policy makers and legislators. There should be engagement with the academic institutions that instruct youth and thus directly affect the future. FAO's decentralised offices should play a dynamic role in such information sharing and public awareness building.

19. FAO should document and monitor processes of land concentration worldwide.

Need of public awareness

20. There should be an increase of public awareness on the effects of consumption patterns, as well as other options for consumption with lower effects on climate change and values of small scale farming and local consumption.

21. FAO should facilitate neutral platform for exchange of ideas and alternative paradigms for agriculture and development

Better coordination among UN Agencies

22. There should be genuine international coordination, prioritisation and collaboration/communication amongst the UN and other international agencies. There should be greater inter-agency consultation on these issues to share information and develop complimentary positions such as linking food security with environment and trade.

B. ***Food Security and Bioenergy***

Concerns relating to risks of bioenergy

23. FAO's focus should clearly put priority first on food security, not on alternative uses for agricultural production that put food availability at risk for the most vulnerable. There is a major food security concerns due to competition.

24. Participants cited research noting: the negative "tradeoffs" of biofuel *versus* food production for food security; criticism of the likely benefits of 2nd generation technologies in a recent IFPRI study, bioenergy work in IFAD, UN FCC, and CGIAR.

25. There are existing combinations of government support and private investments dispossessing people of their land and putting public lands already in use by rural peoples into non-sustainable and non biodiverse agricultural practices.

26. The predominant models of industrial agriculture and biofuels are not sustainable and not viable. Conversions of land to bioenergy production have already had significant negative impacts on smallholders and the poor in rural areas.

Defining Bioenergy separate from Biofuels

27. It is important to distinguish biofuel from bioenergy. Biofuel essentially refers to liquid fuels used for transport and energy generation. Bioenergy is broader term incorporating different kinds and sources of energy needs in rural areas (such as fuelwood and small-scale, community energy production).

28. FAO should examine the range of evidence regarding the economic, social and environmental impacts through a life cycle analysis of the 1st and 2nd generation biofuels. These are not sustainable and do not offer viable alternatives for GHG emissions. The broad claims of sustainability and other benefits for 2nd generation biofuels should be examined very critically, as well as providing a comprehensive assessment of the current biofuels.

A call for an establishment of a moratorium

29. In view of all of the above concerns (from numbers 24 – 28), majority of the participants considered that it is urgent to establish a *moratorium* on using land for biofuel production in developing countries. Thus, it is against food security and will not address the needs of

small producers, rural people and the poor. But, one participant expressed a different view and opposed the moratorium.

Positive contributions and other alternative energy sources

30. Sustainable bioenergy production at local level provides a good chance to improve local energy supply.

31. Consideration of bioenergy alternatives should also be linked to assessment of other energy sources such as solar and wind. There is need to the shift the international agenda away from the promise of biofuels towards more sustainable and alternate forms of energy.

32. FAO with its partners should therefore not focus its attention only on biofuels, but put bioenergy into its proper context including the comparative value of other energy sources for rural areas such as solar and wind.

33. In the European Union, where legislation regulations exist on biofuels, farmers support continued production of oilseeds for such use. For bioenergy, a multidimensional approach should take into account many factors, including impacts on biodiversity (and the unfavourable impacts of monocultures), pollutants, deforestation, soil fertility, social conflicts and biomass.

North-South Conflict of Interest

34. International trade in biofuels benefits countries in the North, which are searching for new sources of energy without providing benefit to the South. This takes the classic form of export of raw materials with low benefit to smallholders. The general impacts on smallholders are negative. Large scale, industrial forms of production will have the advantage.

35. FAO should assist in the development of proposals for energy alternatives for rural areas, especially for those regions with meagre or vulnerable energy options.

FAO'S ROLE IN DISASTER RISK REDUCTION

1. DISASTER FREQUENCY AND SEVERITY IS INCREASING

The world has witnessed an alarming increase in the frequency and severity of disasters: 240 million people were affected by natural disasters globally each year on average between 2000 and 2005. During this time these disasters claimed an average of 80 000 lives annually and caused damage of an estimated US$80 billion per year[1]. Farmers, pastoralists and fishermen in rural areas are particulaly often hit by droughts floods and tropical storms. The majority of victims are the vulnerable and poor.

Disaster losses are increasing owing to a number of factors, including increased extreme weather events associated with climate change, population growth, unplanned urbanization and environmental degradation. A crucial observation by FAO is a shifting balance between man-made and disasters induced by natural phenomena; Worldwide, the proportion of food crises that are mostly man-made (economic constraints or policy failures, insecurity, and conflict) were cited as main causes for about 10 percent of food emergencies during the early 1980s. This increased to almost 70 percent by 1993. Since then, however, there has been a downward trend, with natural causes becoming the principal reason of food crises in about 40 percent of cases in 2007. The IPCC 4th assessment report (scientific evidence) points to a future where climate induced hazards and disasters will further increase.

2. CONCEPTS AND PRINCIPLES[2]

Disaster *risk* results from the combination of a potential damaging event- the *hazard*; and the degree of susceptibility of the elements exposed to that source – *vulnerability*.

- Natural *hazards* can be classified according to their geological (earthquake, tsunamis, volcanic activity), hydrometerological (floods, tropical storms, drought) or biological (epidemic diseases) origin.

- *Vulnerability* conditions are determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards. The recognition of vulnerability as a key element in the risk notation has also been accompanied by a growing interest in understanding and enhancing the positive capacities of people to cope with the impact of hazards. These *coping capacities* are closely linked to the concept of *resilience*:

- *Resilience* is defined as the capacity of a system, community or society potentially exposed to hazards to adapt and maintain an acceptable level of functioning.

- *Disaster risk reduction (DRR)* includes the systematic development and application of policies, strategies and practices to avoid (*prevention)* or limit (*mitigation* and *preparedness*) the adverse effects of hazards.

[1] CRED March 2007, source of data: EM-DAT, does not include victims of conflict, epidemics and insect infestations. More on disaster statistics and issues relating to disaster data: http://www.em-dat.net and http://www.unisdr.org/disaster-statistics/introduction.htm.

[2] Within the disaster community terminology is often applied inconsistently reflecting the involvement of practitioners from a wide range of disciplines. The terms used above are an adaptation from the ISDR terminology, for more detail *see ISDR-Living with Risk, 2004* (http://www.unisdr.org/eng/about_isdr/bd-lwr-2004-eng.htm)

DRR builds on the need of a sound the understanding of vulnerabilities and on the promotion of resilience, in particular of the poor and food insecure. There are two distinct modes of risk reduction: 1st those aimed primarily at the physical environment and 2nd those aimed at human processes, primarily socio-economic. However, in most cases the two are interdependent. The integration of DRR into sustainable development and in sectoral policies and planning is recognized as priority number one by the international community

3. DISASTER RISK REDUCTION: THE ROLE OF AGRICULTURE

FAO estimates that there are still over 850 million undernourished people, of which 820 million are in developing countries. These 820 million people in developing countries tend to be poor, live in rural areas, are dependent on agriculture and/or agriculture-related activities for their livelihood, and are among the most vulnerable to disasters.

Natural disasters can be considered as a cause and product of failed development. Disasters can wipe out years of development in a matter of hours; at the same time it has been clearly demonstrated how disaster risk accumulates historically through inappropriate development interventions. This situation is further aggravated by increased farming in high-risk areas, including geophysical risk areas, as a result of population pressures and lack of diverse economic opportunities.

The link to climate change adaptation provide new challenges and opportunities. Agriculture is perhaps the most climate sensitive sector. Communities heavily dependant on agriculture are increasingly vulnerable (harvests losses, destroyed plantations, salinization, animals losses and disease, etc.). but hazard threats and even post-emergency situations often provide the opportunity to make societies and farmers more aware about their risk and what they could do to reduce their exposure on the impacts of future natural hazards and thus the need for change. Severe disasters often catalyze the resources and momentum necessary to introduce policy reform and to strengthen the capacity of national DRM systems and prepare better for climate change.

Agriculture has a key responsibility in all phases of disaster risk management to complement national DRM systems from a sectoral perspective and carry forward the implementation of the Hyogo framework for action and national DRR strategies, in particular in rural, agriculture dominated areas. Key technical and areas and policy requirements for AG sector interventions and collaboration to promote a comprehensive, cross-sectoral approach to DRR at international and national levels include:

(i) Disaster risk profiling: hazard, risk and vulnerability assessments in ag sector(s).

Implementation of DRR measures needs to be based on an assessment and prioritization of the hazards and risks that people face, as well as their ability to cope and withstand the effects of those hazards. This assessment should in an integrated way: a) identify the typology, frequency and potential severity of an hazard (hazard assessment); b) identify geographical areas and communities that are most vulnerable to those hazards (hazard mapping); c) identify the key factors of vulnerability and local coping and adaptive strategies and capacities; and d) assess gaps in national policies, legislation and institutional capacity for DRM; (e) assess the role of agriculture, livestock, fishery and forestry line departments in disaster risk management and linkages with other relevant institutions[3].

(ii) Promotion of prevention and mitigation

Action for disaster prevention and mitigation focuses on reducing the underlying factors of risk. This normally requires a medium- to long-term planning framework that can allow for adjustment

[3] For this purpose FAO is developing *Guidelines for the assessment of DRM Systems.*

of institutional mechanisms and integration of appropriate measures in sectoral development policies and planning. It includes structural and non-structural measures to provide outright avoidance (prevention) or limit the adverse impact (mitigation) of potential natural hazards. Risk reduction in agriculture requires appropriate sector policy frameworks and institutional mechanisms, sustainable natural resource management practices and the identification, adaptation and dissemination of targeted technical and structural mitigation measures.

- ***Legislation and policies****:* National legislation on DRM is a basic requirement. It would normally include a national act establishing and mandating a national authority for disaster (risk) management and an inter-ministerial commission/committee for policy making and coordination on disaster (risk) management. It would specify responsibilities and tasks of relevant public and private stakeholders in all phases of DRM as well as the coordination mechanism and procedures. Examples of legal and policy issues for the agriculture sector include: risk reduction standards for agricultural infrastructure and construction; clear definitions about the declaration of emergency situations and phasing of emergencies; sector development policies to define priorities and strategies for risk reduction; land use planning and zoning; frameworks to control land degradation and combat desertification; water management; coastal management; forestry conservation; transboundary agreements for watershed managements and control of animal and plant disease.
- ***Institutional structures, capacities and coordination***: The national authority for disaster (risk) management and/or an inter-ministerial commission/committee for disaster (risk) management are normally replicated at district and local government level, ideally allowing for a combination of "top-down" and "bottom-up" approaches. Most DRM functions benefit from devolution of responsibilities (following principles of subsidiarity) provided that this is combined with: clear definition of tasks and effective coordination systems, appropriate budget allocations and capacity building for local staff. Examples of issues to be addressed from the agriculture sector perspective include: representation of agriculture sector line departments in the inter-ministerial commission/committee (including at decentralized levels); definition of technical contributions and capacities of agriculture departments, extension services and agricultural research institutes to DRM systems; linking with other relevant line departments such as water affairs, meteorological services, environment and natural resources) linkages?
- ***Technical interventions for enhanced DRR;*** The day to day development work with farming and fishing communities promoted by AG, FO and FI line agencies, NGOs and other stakeholders provides in most developing countries a good opportunity to embed DRR aspects into ongoing sectoral programmes and activities. Technical intervention areas that can be operationalized through the sectoral agencies in partnership with national and local level DRR committees include

  Agricultural measures such as
  - appropriate crop selection (testing and introducing new varieties, drought/saline/flood resistant crops, quick crowing crops) and animal breeding;
  - improved cropping systems and cultivation methods (crop diversification, intercropping, adjustment of cropping calendars, soil conservation);
  - post-harvest management (storage, food drying, food processing);
  - pest control;
  - sustainable water management: improved design, construction and maintenance of irrigation and water control infrastructure; rainwater harvesting; water conservation techniques; and
  - afforestation/reforestation and agroforestry.

  Sector specific infrastructural measures: examples include
  - raised seeds beds, dams, wind breaks, fire breaks;
  - proofing of storage facilities and livestock shelters;
  - erosion control structures, routine clearing of drainage system and canals; and

- safe rescue places/platforms and strategic animal fodder reserves
- drought resilient strategic water points
- earthquake proof fish ponds and irrigation facilities
- flood safe seed and fodder stocking infrastructure

Linking Early Warning Systems with agricultural sector needs

The purpose of the EWS is to detect, forecast and, when necessary, issue the alert relating to impending hazard events. However, in order to be effective and fulfil a risk reduction function in the agriculture sector alerts need to:

- be associated on information on possible impact on the agriculture sector and on what farmers can do to reduce disaster risk;
- be communicated in a way that is understandable by vulnerable people;
- transmitted through media accessible to rural farming and fishing communities;
- take into consideration issues relating to people's risk perceptions and trust in public institutions4;
- where possible include medium and long-range climate forecasts to allow for contingency cropping plans.

Socio-economic measures: *examples include*

- risk sharing and transfer instruments: crop/livestock/fishery insurance, compensation and calamity funds, micro-credit and cash transfers; and
- livelihood diversification: may include small-scale enterprise development, introducing new farming activities (small-scale livestock, fish ponds, new crops of higher market value) or promoting non-farm activities.

Training and awareness raising

- Regular awareness raising and training of those who might be affected by a disaster and those who will be providing support to the affected communities.
- Dissemination and practical demonstrations of good practices for DRR form sectoral and cross-sectoral perspectives to increase resilience of existing farming systems
- Regular mock exercises to simulate the real event and individual responsibilities and tasks.

(iii) Preparedness:

Preparedness measures are taken directly in advance of an announced or expected hazard to prepare for and reduce its effects and potential impacts. That is to further reduce through short term preparatory activities the impacts of a forecasted event on vulnerable populations, and to be ready to effectively respond to the consequences. Key components of disaster preparedness are the issuing and dissemination of hazard warnings and alerts (through EWS), contingency planning for the post disaster situation, protective infrastructural measures and household level preparedness measures.

- ***Dissemination of hazard alerts and EW messages at local level****;* National and local responsibilities must be defined and capacities in place to ensure immediate outreach to the most vulnerable households and people living in marginal or remote areas; local DRR groups or farmer'cooperatives and associations have proven to be suitable mechanisms to assist.

[4] Some of the above issues can be tackled with EWS based on multiple sources of information for for vulnerable rural communities. For example: a) national weather forecasts; b) local irrigation authorities monitoring hydrological parameters; c) river level monitoring from local communities. These systems have the advantage of allowing the application both of local knowledge and of science/technology based knowledge.

- ***Contingency planning***: During the actual emergency, quick and effective action is required. Effective action will often depend on the existence of ready-made and tested contingency plans, which should be available at national, provincial and local level. When provincial and local level plans are not in place, translating recommendations into action becomes very difficult. Contingency plans at different levels should be complementary and ensure that appropriate linkages are established for coordination and to support action along lines of command. Contingency planning measures are normally associated with life-saving measures (evacuation procedures and identification of safety sites, search and rescue etc.) however these may also be a key instrument for saving equipment, livestock, seeds and other agricultural inputs. Contingency planning in the agriculture sector includes: contingency crop planning (changing of cropping patterns to match late/early rains, availability of seed of drought, flood, salinity tolerant crop varieties, famine reserve crops etc.), conservation of forage/fodder, moving of animals to safer grounds, plans for vaccination of livestock exposed to flooding, emergency seed procurement networks; safety at sea measures for fisherman.

- ***Protective structural measure and household level prepared*ness**: communities and households are the first line of response in any emergency and many disasters occur on a small/regular basis unnoticed by national authorities and international organizations community. Community-led initiatives play a major role in immediate response (saving lives and moving people to safer grounds, providing emergency food and shelter) and recovery (mutual support in reconstruction work), but are rarely recognized, sustained and integrated by the formal disaster risk management systems. Examples of community/household preparedness measures are: Cleaning of drainage channels, pruning of tress exposed to hurricanes, bring animals and seeds at secure places; prepare buffer capacities of food, fodder and water for humans and animals, basic medical/veterinary package prepared ;stand-by agreements for the use of equipment and machinery such as water pumps, use of fishing boats for rescue operations; emergency harvest if season and time allows (hurricane or flood warning);

4. HOW FAO ENGAGE IN IMPROVING DISASTER RISK REDUCTION

In 2005 the international community adopted the *Hyogo Framework for Action* (HFA) which sets the Strategic Goals and Priority Areas of Action for a ten-year programme *to substantially reduce disaster losses in live, and in social, economic and environmental assets of communities and countries*. The Strategic goals of the strategy are:

- the integration of DRR into sustainable development policies and planning;
- The development and strengthening of institutions, mechanisms and capacities to building resilience to hazards; and
- the systematic incorporation of risk reduction approaches into the design and implementation of emergency preparedness, response and recovery programmes.

As the UN Specialized Agency for the food and agriculture sectors, FAO has the responsibility of assisting member countries in integrating DRR measures in agriculture and food sector policies and practices and has a key role to play in protecting and restoring agriculture based livelihoods in the aftermath of a disaster, and in view of future impacts to be expected from climate change[5].

FAO supports member countries in various ways in their efforts of strengthening DRM systems and integrating disaster risk reduction in sustainable development planning, as well as into the implementation of emergency preparedness, response and recovery:

- undertaking hazard profiling and vulnerability assessments for the agriculture, forestry and fishery sectors or participating in national/local multi-sectoral disaster risk profiling exercises;

[5] UN/ISDR, Hyogo Framework for Action 2005-2015. Available at: http://www.unisdr.org/eng/hfa/docs/Hyogo-framework-for-action-english.pdf . For the role and contributions of International Organizations see para 32.

- assessing and enhancing capacities for DRR within sectoral line departments and extension services;
- integrating DRR in sectoral development plans or country programming exercises (United Nations Development Assistance Framework [UNDAF], National Medium-Term Priority Framework [NMTPF])[6];
- promoting sustainable natural resource management (for example on: land, water, watershed, forestry, or coastal areas);
- identifying, documenting, adapting, and facilitating the exchange and replication of good agriculture, fishery and forestry practices for disaster risk reduction;
- participating in inter-agency processes for enhancing emergency preparedness in the country;
- providing emergency response, integrating the building back better principle in the design and implementation of post-emergency assistance

[6] Tools for integrating disaster risk reduction in country programming see : ProVentin Consortium, *Tools for Mainstreaming Disaster Risk Reduction,* (http://www.proventionconsortium.org/themes/default/pdfs/tools_for_mainstreaming_GN4.pdf)

THE ROLE OF LOCAL INSTITUTIONS IN REDUCING VULNERABILITY TO RECURRENT NATURAL DISASTERS AND IN SUSTAINABLE LIVELIHOODS DEVELOPMENT

Consolidated report on case studies and workshop findings and recommendations

FAO

Findings and lessons learnt

Case study findings and workshop discussions confirmed the basic assumption that locally organized preventive as well as responsive action to disasters could be very powerful to limit damage and losses, and that they are crucial to complement higher level activities in emergencies. They also confirmed that what is lacking is a good understanding about local experiences and knowledge and concrete guidance on how to strengthen the role of local government and community-based organizations in DRM and improve their ways of communication and active interaction.

The data and workshop discussions indicate that local institutions and organizations are key actors with comparative strengths for DRM as outlined in the initial pre-study working hypotheses. LOCAL institutions derive their strengths from proximity, responsiveness to social pressures and adaptation. However, to be verifiable, these hypotheses should include the following additional considerations:

- The conventional disaster cycle used by FAO has only limited value for integration between disaster risk management and longer-term development. The focus of the disaster cycle is on the management of the different phases and not on integration of risk into long-term development planning and management. Hazards and disasters are not problems that can be solved in isolation. Hazard risk needs to be linked with natural resource management and economic and social resiliency, within a long-term perspective.

- Local institutions need the appropriate frameworks/enabling environment to function. Local actors often act without a mandate from central level. Concrete/effective action at local level requires a mandate for them from central level and a revenue system which also allows for resource mobilization at local level. The central administration/government is the key actor in policy formulation. DRM requires a combination of “top-down” and “bottom-up” approaches to reduce risk and make disaster response and rehabilitation more effective. Effective coordination systems benefit from decentralized governance, once clearly defined roles of local government are in place. Critical aspects include: (i) devolution of responsibilities; (ii) appropriate budget allocations; (iii) institutions at different levels and in different sectors that are mutually supportive (vertical and horizontal coordination); (iv) clear definition of tasks; (v) strong partnerships with civil society and the private sector; (vi) integration with sectoral development plans.

- The functioning and comparative strengths of local institutions depend upon the type and scale of natural disasters. There is a threshold beyond which local institutions are no longer able to prepare for and respond effectively to a disaster. While recurrent natural disasters are better managed at the local level, exceptional/extreme events also require support from the national/local government and international community. Furthermore, while human-induced components of disaster response imply a focus on institutional capacity-building, some elements of the natural hazard management, in particular agricultural risk adaptation practices, are better managed through conventional technical assistance/transfer of technology practices, thus stressing the important link of DRM to agricultural extension.

- Another pre-requisite for effective DRM is its integration with natural resource management and long-term rural development, particularly in the areas of land use and watershed management. Natural disasters are often a consequence of inappropriate natural resource

management and there is often a clash between local DRM strategies and practices and national development policies strategies; these issues need to be addressed at central government level and require negotiation and participation at local level.

- Partnerships between local government, the private sector, non-governmental organizations and community groups are more effective and need fostering than single institutions working independently. This is particularly evident in the areas of: natural resource management, financial services and conflict management.

- Social capital is the key factor ensuring immediate responses to disasters (saving lives and moving people to safer grounds, providing emergency food and shelter) and has a very important role also in the rehabilitation phase (credit, mutual support in reconstruction work), especially when there is no formal system in place. However, spontaneous initiatives related to the prevention and preparedness for disasters and risk are rare. Mitigation measures normally require support from formal institutions. Adaptation strategies to recurrent small-scale hazards are common but extreme events are often perceived as “acts of God” and no preventive measure is taken. All case studies provided evidence that local social capital plays a key role in immediate relief operations. Where there is no official coordinating mechanism the local community carries out all rescue and relief functions on the basis of its informal networks. Emergency relief operations can be “used” to facilitate the recognition of the role of local social capital by: a) allocating roles and responsibilities in the distribution of relief goods and provision of relief services; b) identifying policy and legislation gaps; c) providing local and national government support to develop normative frameworks which would capitalize on local informal networks.

EXTENDING THE REACH OF RURAL INSTITUTIONS

CGIAR, March 2007
http://www.cgiar.org/

A group of social scientists in the CGIAR has taken an important step toward a more cohesive approach to research focused on strengthening rural institutions. This work is vital for enabling the rural poor to build sustainable livelihoods and cope with climatic, environmental and economic change. By late March, the group will have developed a draft "framework plan" for research on "rural institutions and their governance." These include farmer associations, other kinds of community-based organizations as well as partnerships involving the private sector, public agencies and civil society (CSO) organizations.

All of the CGIAR-supported Centers work closely with such institutions in their collaborative research. Some of that research deals with the institutions themselves and their role in sustainable development – a research topic that figures among 20 priorities established in 2005 by the Science Council of the CGIAR. Arguably, research on rural institutions (referred to as "priority 5C") merits special attention, because progress in this sphere profoundly influences the impact of research on all other priority topics – including biodiversity; crop improvement; high-value agriculture; and sustainable management of water, land and forest resources.

Progress in strengthening rural institutions requires, not just more support for particular organizations in rural areas, but a better understanding of how policy incentives, human capacity development and other interventions can better enable rural people, through their organizations, to shape and benefit from the decisions that affect them.

Linking Research with Development

To assemble the components of the framework plan and trade ideas with experts from other organizations, social scientists from several CGIAR Centers took part in two back-to-back workshops held at Washington, D.C., in mid-February. The first, entitled Mobilizing Rural Institutions for Sustainable Livelihood and Equitable Development, was organized by the Social Development and Agricultural and Rural Development Departments of the World Bank's Sustainable Development Network (SDN), jointly with the CGIAR Secretariat. For details, see the event Web site

A central aim of this event, said Kathy Sierra, who is SDN Vice President and CGIAR Chair, was to identify ways of linking the latest in research with World Bank development operations through "joint action on the ground" that benefits the poor. "The inspiration for this effort," commented Steen Jorgensen, Director of SDN's Social Development Department, "comes from a combination of previous frustrations and successes" with rural institutions.

During the event's morning session, presentations by experts in the field and panel discussions drew attention to a number of key points about the role of rural institutions in sustainable development: for example, their importance in strengthening the position of small farmers in agricultural "value chains" (particularly for higher value products, such as coffee) and the need to invest in the institutions, assets and capabilities of the poor, so they can "reach out" to public and private services – in contrast with the traditional paradigm of formal institutions "reaching out" to the poor.

These points were reinforced by World Bank Executive Director Jiayi Zou, who in opening and co-chairing the morning session, remarked on the advantages of farmers' own organizations over government-led efforts to organize growers. She also cited the key role of rural institutions in China's market reforms and emphasized their importance in maintaining the traditional social fabric while modernizing agriculture.

The afternoon session consisted of presentations and working group discussions on activities supported by the World Bank Trust Fund for Environmentally and Socially Sustainable Development (TFESSD). The Fund is supporting five in-depth case studies –in Afghanistan, Ethiopia, India, Vietnam and Yemen – designed to determine how Bank development operations can best contribute to enhancing the capacity of local rural institutions, both generally and in these particular countries.

“In recent years, we’ve witnessed the virtual dismantling of some rural institutions in the developing world,” noted CGIAR Director Francisco Reifschneider during the closing session. “Now, it’s time to see how good we are at helping build new and better ones.”

A More Harmonized Way of Working

By setting out key issues and examining diverse case studies, the World Bank workshop nicely set the stage for a day of discussions specifically about CGIAR research on rural institutions. This second event was organized by the International Food Policy Research Institute (IFPRI) and International Center for Tropical Agriculture (CIAT), with the Science Council Secretariat.

The CGIAR commits about US$26 million (or 5 percent of its total budget for 2007) to research on rural institutions through 80 different projects across 15 Centers, noted Ruben Echeverria, Executive Director of the Science Council Secretariat. The framework plan, he suggested, should give rise to a “more collective and harmonized way of working” that generates greater impact from donors’ significant investment.

In donor support for this research, reducing the vulnerability of rural communities, particularly in the face of forces such as climate change, “is at the top of the agenda,” noted World Bank Agricultural Specialist Willem Janssen, who was among several external experts attending the CGIAR workshop.

This event was not about fitting current activities into “new formats,” said IFPRI scientist Ruth Meinzen-Dick, but rather was intended to define a “compelling agenda” – one that could provide a strong basis for organizing collaborative research and underline its relevance to other global initiatives.

To identify key elements of that agenda, CGIAR social scientists conducted a quick inventory of current research on rural institutions in the Centers. This work is remarkably diverse, encompassing topics such as the development and dissemination of new agricultural technology, small enterprise development to strengthen farmers’ market links and participatory approaches to community-based natural resource management. Through group discussions, workshop participants then defined the goals, key questions and requirements of a more collaborative approach to this research.

In many of the CGIAR Centers, research on rural institutions has found its “intellectual home” in impact evaluation. And a central concern of social scientists engaged in this work is to ensure that technological, institutional and policy innovations genuinely benefit the poor. If they are to achieve that goal, then research on rural institutions must be, not just an “auxiliary,” as one Center participant put it, but a vibrant component of the CGIAR’s contribution to sustainable agricultural development.

IMPACT OF CLIMATE CHANGE ON RURAL POOR

Climate change resulting from increased greenhouse gas (GHG) concentration in the atmosphere is a serious threat to anti-poverty development efforts in low-income Asian countries. The Intergovernmental Panel on Climate Change (IPCC) estimates that man-made greenhouse gas emissions have risen by 70% over the past three decades and will increase notwithstanding current climate change mitigation policies and related sustainable development practices.[7]

Climate change will have serious impacts on all four dimensions of food security: food availability, food accessibility, food utilization and food systems stability.[8] Agriculture-based livelihood systems – small-scale rainfed farming systems, pastoralist systems, inland and coastal fishing/aquaculture communities, and forest-based systems – face immediate risk of increased crop failure, loss of livestock and fish stocks, increasing water scarcities and destruction of productive assets.[9]

Agriculture is both culprit and victim: the livestock sector accounts for an estimated 18% of global greenhouse gas emissions and deforestation 18 % carbon dioxide emissions; the world's 130 million ha of rice paddies are estimated to produce 50 to 100 million metric tonnes of methane annually.

CLIMATE CHANGE IN FAO

http://www.fao.org/nr/clim/clim_en.htm

FAO has a very active inter-departmental cooperation on climate change issues to provide consistent and comprehensive advice to all Members Countries, and the provision of technical inputs to negotiation processes, and strengthening information dissemination. It enables FAO to support the implementation of the UN Framework Convention on Climate Change (UNFCCC), and provide technical inputs to mitigation and adaptation measures. FAO plays an important role in assisting Member Countries with climate change issues related to agriculture and food security.

FAO's programme on climate change includes

- the promotion of practices for the mitigation and adaptation of agricultural systems, and for the reduction of emissions from the agricultural sector considering the major objective of ensuring food security,
- the development of practices aimed at increasing the resilience of agricultural production systems,
- national and regional observing systems, as well as
- data and information collection and dissemination.

[7] IPCC Fourth Assessment Report, 2007
[8] C*limate change and food security: a framework document.* Food and Agriculture Organization (FAO)
[9] Ibid

The FAO Natural Resources Management and Environment Department (NR)

http://www.fao.org/nr/dep/about_en.htm

The responsible management of natural resources is the key to attaining sustainable agricultural and rural development. FAO has long been at the forefront of promoting natural resources management and environmental protection in its work, but, as of 1 January 2007, this commitment has been strengthened by the creation of the new Natural Resources Management and Environment Department. Its main functions are to support environmental services, to promote the sustainable management and use of land, water, and genetic resources, and to strengthen agricultural research and extension systems. The Department takes the lead in the areas of bioenergy, climate change issues, land and water management, land tenure issues, biodiversity for food and agriculture, and research and extension.

The Natural Resources Management and Environment Department has three Divisions:

- Environment, Climate Change and Bioenergy Division
- Land and Water Division
- Research and Extension Division

Environment, Climate Change and Bioenergy Division

The Environment, Climate Change and Bioenergy Division builds upon the work of the former Environment and Natural Resources Service, with particular attention focused upon the role of rural institutions in addressing local development issues. This reflects the greater interest expressed by member countries in Climate change issues related to agriculture, forestry and fisheries. The new Division assists member countries both in the mitigation of climate change and in the development of adaptive capacities of agriculture, fisheries and forestry to the effects of climate change. This assistance is made available through a variety of approaches, including technical support, policy tools, institutional strengthening, guidelines and best practices.

While FAO has been involved with Bioenergy for the past three decades, the structure of the new Department places a greater emphasis on FAO's work in Bioenergy for poverty alleviation, food security and climate change mitigation and increases opportunities for cooperation with member countries, other organizations and private-public partnerships. The Division continues to serve as a focal point for organizing and facilitating a multidisciplinary and global approach to bioenergy through the mechanisms of the International Bioenergy Platform (IBEP) and the Global Bioenergy Partnership (GBEP). IBEP is expected to provide analysis and information for policy and decision-making support; to build and strengthen institutional capacity at all levels; to enhance access to energy services from sustainable bioenergy systems; and to facilitate opportunities for effective international exchange and collaboration.

Land and Water Division

The Land and Water Division integrates the work of the Water Development and Management Unit, previously the Water Resources, Development and Management Service located in the Agriculture Department, and the Land Tenure and Management Unit, comprising the Sustainable Development Department's Land Tenure Service and staff from the former Land and Plant Nutrition Management Service of the Agriculture Department. The Division is concerned with the productive and sustainable use of land and water resources through their improved tenure, management, development and conservation, in order to increase food security, alleviate poverty and secure a healthy environment. The Division will enhance its assistance to member nations in developing policies, programmes, best practices and tools for land tenure in order to facilitate access to land and to ensure user rights, including access to natural resources, and to improve land markets. The Division, by offering an integrated land and water management approach,

Addresses long term sustainability of land and water quality and quantity, and the development of irrigation and rainfed agriculture.

Research and Extension Division

The Research and Extension Division, through its Research and Extension Unit, provides advisory and technical services to FAO Members to support an integrated approach to agricultural research, extension, education of rural people and communication for development, in order to respond to the technology, knowledge, human and institutional capacity building and public awareness needs of national development policies and strategies. Work in this area concentrates primarily on supporting and enhancing the capacities of public and private-sector agricultural Research and Extension systems, as well as Education for Rural People and Communication for Development institutions, with special emphasis on Rural radio.

The Division's activities are focused on establishing strong linkages among researchers, extension managers and advisors, educators, communicators and producers and users of agricultural, rural, environmental and natural resource knowledge and technology as well as building partnerships at the national and international level. The Unit contributes also to activities related to capacity building for the safe application of Biotechnology. The Division acts as a liaison point with the international agriculture research system, including regional Fora and networks, the Consultative Group International Agricultural Research (CGIAR) and its International Agricultural Research Centers.

The Research and Extension Division hosts the Secretariat of the Global Forum on Agricultural Research (GFAR). GFAR is a stakeholder-led initiative that serves as a neutral forum for the discussion of strategic issues in agricultural research for development. It facilitates and promotes cost-effective partnerships and strategic alliances among agricultural research for development stakeholders in their efforts to alleviate poverty, increase food security and promote the sustainable use of natural resources.

Adaptation to climate change in agriculture, forestry and fisheries: Perspective, framework and priorities

FAO Inter-Departmental Working Group on Climate Change

The risks and vulnerabilities of the poor who live in insecure places and need to build their resilience to cope with climatic fluctuations are among the more important challenges in adapting to increasing climate variability and climate change. FAO has developed and tested a livelihood-based approach to promote climate change adaptation processes at grass root level building on the assumption that most rural communities in LDCs (as well as in other developing countries) work on the basis of day-to-day priorities rather than for the longer-term. The basic processes associated with the approach to working with farmers, fishermen and livestock keepers at local level therefore involve:

- assessing and understanding current livelihood systems, indigenous knowledge, adaptive capacities and vulnerabilities;

- starting work on the issues that matter today and, based on that:

  (i) identifying and promoting options to adapt to climate variability, jointly with local agricultural producers and research institutes and extension;

  (ii) enhancing local adaptive capacities by linking multiple stakeholders, and

(iii) adding a longer-term perspective to the above;

(iv) ensuring non-discriminatory adaptation policies.

Considerable "expert judgment" or accumulated experiences are available in farming communities who live with climate risks over time. The availability of usable science-based climate prediction information needs to be tailored to farmer needs by matching it with traditional practices and incorporating existing local knowledge. To facilitate this process science-society integrators who orient climate modelling research to meet farmers' need and vice versa can provide feedback to the climate science community on the application value of their research. These integrators need to be part of the initial institutional set-up, with specific responsibilities and terms of reference.

An important aspect in the above is to analyse the dimensions of climate change impacts and adaptation patterns on gender and the implementation of human rights including issues such as: how does climate change aggravate existing problems in the areas of food and water security; does this affect women's and men's lives differently; what are women's needs for improving their access to education, labour markets, and participation in decision-making. Issues include, for example, effects of irrigation water scarcity on women in different regions and the economic and health effects of climate-related food insecurity.

FAO advocates strengthening the capacity of rural institutions to use appropriate tools and strategies such as:

- participatory identification of current vulnerabilities and risk reduction measures, and implementation of prioritized community-based disaster risk reduction activities (e.g. national and sub-national early warning systems);
- strengthening capacity of communities to manage their resources (e.g. savings, credit schemes, agricultural inputs, agricultural production, land use, etc.);
- enhancing the use of technological options to manage climate variability associated risks (e.g. disaster information management system);
- raising awareness of farmers and building capacities of local institutions in support of national disaster management policy;
- advocacy by policy makers on natural disaster risk management and climate change;
- introducing the additional layer of accountability provided by the rights-based approach, and
- partnerships between regional and national research institutions, extension systems and farmers/fishermen.

The FAO Interdepartmental Working Group on Climate Change recommends focus on the following livelihood groups in formulating climate change risk reduction and adaptation strategies:

- low-income groups in drought-and flood-prone areas with poor food distribution infrastructure and limited access to emergency response;
- low-to-medium-income groups in flood-prone areas who may lose homes, stored food, personal possessions and means of obtaining their livelihood, particularly when water rises very quickly and with great force as in sea surges or flash floods,

- farmers whose land becomes submerged or damaged by the rise in sea level or saltwater intrusions;
- producers of crops that may not be sustainable under changing temperature and rainfall regimes;
- producers of crops at risk from high winds;
- poor livestock keepers in drylands where changes in rainfall patterns will affect forage availability and quality;
- managers of forest ecosystems that provide environmental services
- fishers whose infrastructure essential for fishing activities, e.g. port and landing facilities, storage facilities, fish ponds and processing areas, become submerged or damaged by sea level rise, flooding or extreme weather events;
- fishing communities that depend heavily on coral reefs for protection from natural disasters and food;
- fishers/aquafarmers who suffer diminishing catches from shifts in fish distribution and productivity of aquatic ecosystems, caused by changes in ocean currents or increased discharge of fresh waters to ocean.

MITIGATION AND ADAPTATION TO CLIMATE CHANGE[10]

Mitigation of climate change involves actions to reduce greenhouse gas emissions and sequestering or storing carbon in the short-term and making development choices that will lead to low emissions in the long-term.

Adaptation to climate change involves adjustments in natural or human systems and behaviours that reduce the risks posed by climate change to people's lives and livelihoods.

Best practices for mitigating climate change in the food and agriculture sector include:

Reducing emissions of carbon dioxide and other greenhouse gases, e.g., through reduction in the rate of land conversion, better control of wildfires*,* finding alternatives to the practice of burning crop residues after harvest*,* reduction of emissions from commercial fishing operations, and more efficient energy use by commercial agriculture and agro-industries

Reducing emissions of methane and nitrous oxide, e.g., through improving nutrition for ruminant livestock, more efficient management of livestock waste, more efficient management of irrigation water on rice paddies, more efficient management of applications of nitrogen fertilizer on cultivated fields and reclamation of treated municipal wastewater for aquifer recharge and irrigation

Sequestering carbon, e.g., through improving soil organic matter management with techniques such as conservation agriculture, involving permanent organic soil cover, minimum mechanical soil disturbance and crop rotation (also saves on fossil fuel usage); improved management of pastures and grazing practices on natural grasslands, including by optimizing stock numbers, rotational grazing; introduction of integrated agro-forestry systems that combine crops, grazing

[10] *Framework Document on Climate Change and Food Security*, FAO, Inter-departmental Working Group on Climate Change.

lands and trees in ecologically sustainable ways; use of degraded, marginal lands for productive planted forests or other cellulose biomass for alternative fuels; and carbon sink tree plantings.

Best practices for adapting to climate change in the food and agriculture sector include:

Protecting local food supplies, assets and livelihoods against the effects of increasing weather variability and increased frequency and intensity of extreme events through risk management in general and for risks specific to different ecosystems (marine, coastal, inland water and floodplain, forest, dryland, island, mountain, polar, cultivated), through research and dissemination of crop varieties and breeds adapted to changing climatic conditions and through introduction of tree crops to provide food, fodder and energy and enhance cash income.

Avoiding disruptions or declines in global and local food supplies due to changes in temperature and precipitation regimes through more efficient agricultural water management in general, more efficient management of irrigation water on rice paddies, improved management of cultivated land, improved livestock management and use of new, more energy-efficient technologies by agro-industries.

Protecting ecosystems through provision of environmental services, e.g., use of degraded or marginal lands for productive planted forests or other cellulose biomass for alternative fuels, CDM carbon sink tree plantings, watershed protection, prevention of land degradation, protection of coastal areas from cyclones and other coastal hazards, preservation of mangroves and their contribution to coastal fisheries, and biodiversity conservation.

Practices that constitute adaptive responses to climate change have been advocated since the Rio Earth Summit as *good practices for sustainable management of forests, grasslands, fisheries, livestock and arable croplands.* However, incentives to make their adoption attractive are often lacking. These can take several forms, including information, technology transfer and regulations as well as both positive and negative monetary incentives, including polluter and user pays principles, getting rid of perverse incentives that exist (e.g subsidies), and the like.

One relatively new incentive mechanisms is *payments for environmental services* where farmers and communities are compensated for the climate change mitigation benefits they generate through changes in upper watershed management, management of protected areas, rehabilitation and sustainable management of grasslands, and reforestation and afforestation. These payments could potentially also increase adaptation capacity, since many locations where better ecosystem management and use of more sustainable food production practices are most needed are often those where current livelihood systems are most vulnerable to increasing climate variability as a consequence of climate change.

If well designed, such payments could increase the capacity of food producers to insure against risk by diversifying income sources, and also potentially increase employment opportunities for women and youth. Also, as their income source would be more secure, they could be more inclined to invest in inputs, such as tools needed for adapted land management practices. This increased demand would in turn inspire the private-sector input-supply chain to make the required equipments and inputs available in the local markets.

Adaptation to climate change necessitates substantial changes in policies and investment decisions. *Certified Emissions Reduction (CER) trading* is permitted by the Kyoto Protocol and is an instrument that can be used as an incentive for investment in mitigation. However, CER certification methodologies are not yet well-developed and this has limited development of projects in the agriculture sector for funding under the *Clean Development Mechanism (CDM).*

Changes in variability of the prevailing weather conditions and the corresponding *shortening of available time windows for field work*, be it for land preparation, weeding, pest management or

harvest, would invariably result in higher demand for human labour, animal traction or mechanized farm power to carry out the respective work in a shorter available timeframe.

They also require a higher degree of flexibility to get into operation as soon as the weather conditions permit. In mechanized farming systems, shorter time windows results in increasing machinery investments. Where this is not possible, untimely operations would result in yield reductions and eventually in complete crop failure or harvest loss. Where there is a shift from labour to mechanisation, people whose livelihoods depended on employment, can lose their livelihoods and consequently reduce their access to food.

Promoting agro-biodiversity is crucial for local adaptation and resilience

Biodiversity in all its manifestations, e.g., genes, species, ecosystems, increases resilience to changing environmental conditions and stresses. Genetically diverse populations and species-rich ecosystems have greater potential to adapt to climate change. FAO promotes the use of indigenous and locally adapted diversity of plants and animals as well as the selection and multiplication of crop varieties and autochthonous races adapted or resistant to adverse conditions.

Effective use of genetic resources can reduce negative effects of climate change on agricultural production and farmer livelihoods. Moreover, as it is women who are traditionally the carriers of local knowledge about the properties and uses of wild plants and the keepers of seeds for cultivated varieties, they have an important role to play in protecting biodiversity. Providing appropriate compensation for this service could guarantee a sustainable livelihood to these women, many of whom belong to vulnerable and food insecure groups.

Breeding plants and animals for tolerance to drought, heat stress, salinity and flooding will also become increasingly important. FAO is actively promoting rebuilding of national capacities in developing countries to breed such crops, especially those that are not being attended to by the private sector. The Global Partnership Initiative for Plant Breeding Capacity Building (GIPB), facilitated by FAO, was launched on the margins of the first Governing Body Meeting of the International Treaty on Plant Genetic Resources and intends to contribute to Article 6 of the Treaty with respect to sustainable use of plant genetic resources.

Raised productivity from improved agricultural water management will be key to ensure global food supply and global food security

With respect to agricultural water management, increasing water scarcity and changes in the geographic distribution of available water as a result of climate change pose serious risks for irrigated agricultural production globally. With a more variable climate and as a result of less reliable weather patterns it will be essential to increase the water storage capacity for agriculture in order to maintain global food supplies while also satisfying other competing uses for agricultural water.

Looking ahead to 2030, irrigated areas will come under increasing pressure to raise productivity with respect to water, both to buffer the more volatile rainfed production (and maintain national production) and also to respond to declining levels of this vital renewable resource. This risk will need to be managed by progressively adjusting the operation of large scale irrigation and drainage systems to ensure higher cropping intensities and start closing gaps between actual and potential yields.

Conservation agriculture can make a significant difference for efficiency of water use, soil quality, capacity to withstand extreme events and carbon sequestration.

Sustainable livestock management practices for adaptation and associated mitigation should be given high priority.

Fishing and aquatic food production offer sustainable livelihood opportunities for people living by seacoasts, rivers and lakes, but these livelihoods are threatened by climate change.

Some 200 million people and their dependents worldwide, most of them in developing countries, live by fishing and aquaculture. Fish provide an important source of cash income for many poor households and are a widely traded food commodity. In addition to stimulating local market economies fish can be an important source of foreign exchange. Fishing is frequently integral to mixed livelihood strategies, in which people take advantage of seasonal stock availability or resort to fishing when other forms of food production and income generation fall short. Fishing often is related to extreme poverty and may serve as a vital safety net for people with limited livelihood alternatives and extreme vulnerability to changes in their environment. However, the *viability of fishing as a sustainable livelihood is threatened by climate change*.

Fishing communities that depend on inland fisheries resources are likely to be particularly vulnerable to climate change; accessibility to water resources and arrangements with other sectors for sharing and re-use will become a key to future sustainability. Climate change is also likely to have substantial and far-reaching impacts on coastal fisheries and fishing communities. Fishing is essential a "hunting" activity, so its success or failure is heavily dependent on the vagaries of nature. Climate change is creating more anomalies, both in failures and bonanzas, among multiple species, as well as a drastic shift in the areas where small, migrating fish are found. Finally, coastal peoples and communities that depend on fishing in locations where relocation is inevitable due to a rise of sea level will require extra support, as they must not only migrate, but in many instances must also find new, unfamiliar ways to earn a living.

Meeting growing demand for bioenergy should not undermine food security.

Demand for bioenergy has been growing because of the rising cost of petroleum and the mitigation benefits of reducing reliance on fossil fuels. Biofuel crops have potential for large-scale production, but production and processing of these crops requires fossil fuel inputs. Hence their use will only contribute to climate change mitigation if the fossil fuel savings exceed the amount used. Moreover, regardless of mitigation potential, most sources of liquid biofuels are currently not commercially viable without subsidies, mandates and/or tariffs. If subsidised production of biofuel from field crops becomes an important factor in global agricultural markets, this will create additional competition for land and water, putting upward pressure on food prices and increasing the risk of continued deforestation and other adverse environmental consequences.

So-called "*second generation biofuels*," which rely on biomass from woody matter and crop residues rather than cultivated crops, may be more efficient and create less competition for scarce land and water resources, although competition with grass based livestock systems may occur locally. Over the last few years there has been marked acceleration in the development of economically feasible technologies for the production of ethanol from wood chips and other non-food plant life (cellulosic ethanol), and the technologies are now being commericalized in the US, Canada, Brazil, Europe and Japan.

Planted forests account represent only 7 percent of global forest cover, but they account for over half of global industrial roundwood production. There is significant potential for further expansion of planted forests on marginal lands or lands released from crop or livestock production. Increasingly, *sustainable industrial roundwood for bioenergy use* will come from planted forests rather than native forests.

Less publicised, but equally important, is the *energy demand of both rural and urban poor.* In many parts of the developing world the poorest people use manure, twigs and low grade biomass for cooking and heating and nothing but human force in their productive activities. As they become less poor and move up economically, they switch to fuel wood moving progressively to charcoal, kerosene, gas and electricity and integrating animals and simple tools. At a certain level

of development they will manage to integrate some level of mechanization, irrigation and fertilization that implies a switch to fossil fuels.

In both household and economic activities the “energy ladder” follows and influences the “economic ladder.” Attempts to alleviate hunger and to promote rural development and food security must be accompanied with efforts to promote the role of energy as a key component of those attempts. Many parts of the developing world are suffering from lack of adequate energy/farm power resources for agricultural and food production itself. Better management of biomass sources of fuel for household use is essential to reduce deforestation, control carbon dioxide releases, and address the energy poverty that constrains sustainable development in many parts of the world.

Although the debate about biofuel / food security tradeoffs has so far focused mainly on how to manage competing demands on scarce productive resources, it is equally important to focus on energy saving and efficient energy use that will contribute to reduced demand for energy, including bioenergy.

New patterns of pests and diseases will emerge, affecting plants, animals and humans alike and posing new risks for food security, food safety and human health.

Changes in vectors for climate-responsive pests and diseases and emergence of new diseases could impact both the food chain and people’s physiological capacity to obtain necessary nutrients from the foods consumed. Vector changes are a virtual certainty for pests and diseases that flourish only at specific temperatures and under specific humidity and water irrigation management regimes. This will expose crops, livestock, fish and humans to new risks to which they have not yet adapted. Where such vector changes can be predicted, varieties and breeds that are resistant to the likely new arrivals can be introduced as an adaptive measure.

Learning to live with uncertainty is one way of adapting to climate change.

Although there is a solid scientific basis for global climate change projections, *reliable information* about how climate change will play out in specific locations is still largely lacking. Knowledge about the future will always be uncertain, but improving the science can help reduce the current high degree of uncertainty about potential local impacts of climate change. Other priorities include recognizing the need for decision-making in the face of uncertainty, bridging the gap between scientific and traditional perceptions of climate change and promoting adoption of practices that are consistent with the principles of the precautionary approach and adaptive management and that will strengthen resilience and sustainability of vulnerable livelihood systems.

Increasing weather-related losses are causing private sector insurers to restrict the types of natural disasters or catastrophic events that can be insured and it is not clear whether public sector safety net programmes will be able to pick up all of the slack. Since climate-related risks affect us all in one way or another, *innovative insurance schemes* such as a global re-insurance fund for climate change damage, or expanded local coverage of weather-based insurance are likely to be needed.

It is possible to reduce risks by mainstreaming *national risk management policy frameworks* in policies and programmes for sustainable development. These should include pre-event preparedness, risk mitigating strategies, reliable and timely early warning and response systems, and innovative risk financing instruments to spread residual risks. Critical public sector priorities are to address widening systemic risks that affect agricultural production and to support the private sector to develop insurance products for less severe events and for individual, independent farm risks.

Adopting an integrated strategic approach represents the best way forward.

Food security is the outcome of food system performance at global, national and local levels, and is often directly or indirectly dependent on *terrestrial and aquatic ecosystem services*, e.g., soil and water conservation, watershed management, combating land degradation, protection of coastal areas and mangroves, and biodiversity conservation.

Food and agriculture practices that would provide these services and/or reduce emissions or sequester carbon in developing countries represent good adaptation options for vulnerable livelihood systems. However, adaptation is more than this. For DFID, "Adaptation is about reducing the risks posed by climate change to people's lives and livelihoods." In many instances, technological or institutional innovation may hold the key. Just as industrialization has speeded up the process of climate change, so too has it speeded up man's capacity to innovate.

The IPCC has recognized the merit of an *integrated strategic approach* for responding to climate change, but since resources for mitigation and for adaptation are managed through different funding mechanisms, they are still treated separately on the international climate policy agenda of the UNFCCC/COP and its subsidiary bodies. Perhaps equally important are the current institutional frameworks built on sectoral lines. If the various ministries cannot work together, perhaps new, integrated institutional structures are needed. Using food security as an entry point for evaluating priorities for food system responses to the challenge of climate change may offer an opening for developing a more integrated approach.
Supporting those least likely to be able to adapt to climate change is the immediate challenge.

Climate change adaptation requires the use of good agricultural, forestry and fisheries practices to meet changing and more difficult environmental conditions, and the systematic introduction of improved risk management measures in all parts of the world where the impacts of climate change are expected to be felt, and where food security may be at increased risk. FAO can contribute to *climate change adaptation in a variety of ecosystems*, including agro-ecosystems (crops, livestock, grasslands), forests and woodlands, inland waters and coastal and marine ecosystems. There are numerous potential adaptation options available; FAO's role is to codify these and help local people understand which ones are most applicable to their particular circumstances.

FAO works to build capacities at the national, local and community levels to raise awareness and prepare for climate change impacts. At the government level, the goal is to mainstream climate change strategies and actions in agricultural policies and programmes to reduce vulnerability and provide local communities with site-specific solutions.

FAO provides a neutral forum for sharing information about best practices, holding technical discussions and facilitating negotiated solutions, should this be required. Ongoing activities with rural communities and research institutions provide practical information to countries through global data sets and assessments of scientific evidence, analytical tools and models, crop forecasting and impact monitoring and information dissemination on climate change-related risks.

The ultimate goal is not to enforce a pre-selected mitigation practice or adaptation option on any impacted community or population group, but rather to inform and promote local dialogue about what the impacts of climate change are likely to be and what options exist for responding to it in ways that sustain livelihoods and reduce risk.

Thus the final word on the relationship between climate change and food security will be written, not by FAO experts, but rather by the people themselves whose lives are most immediately affected and whose choices will determine whether their future will be more or less food secure.

Adaptation to Climate Change

FAO Natural Resources Management and Environment Department
http://www.fao.org/nr/clim/clim_en.htm

Most effective contribution in the area of climate change adaptation lies in providing countries with tools and information for adapting their agriculture, fisheries and forestry policies and practices to changing climate regimes and to improve farmers' capacities to reduce risk or make optimal use of climate variability. This includes agro-meteorological data and tools for assessing the impact of extreme weather and for guiding adaptation; improving management advice to farmers on the basis of current weather monitoring (contingency planning and response farming); vulnerability assessment tools; guidance on rural livelihood development related to decision making by farmers, herders and fishermen; promoting integrated approaches and synergies between climate change adaptation and disaster risk reduction practices and mechanisms in agricultural sectors; policy advice to strengthen institutional approaches to disaster risk reduction and cimate change adaptation from a sectoral perspective; promoting sustainable natural resource mnanagement as basis of adaptation to climate variability and change; improving household-level food security to help rural populations achieve greater resilience under short-term and medium-term climate variations.

The United Nations Framework Convention on Climate Change refers to adaptation as: Article 2 – Objective: “The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.”

The knowledge and technology required for adaptation includes understanding the patterns of variability of current and projected climate, seasonal forecasts, hazard impact mitigation methods, land use planning, risk management, and resource management. Adaptation practices require extensive high quality data and information on climate, and on agricultural, environmental and social systems affected by climate, with a view to carrying out realistic vulnerability assessments and looking towards the near future. Vulnerability assessment observes impacts of variability and changes in mean climate (inter-annual and intra-seasonal variability) on agricultural systems.

SYNERGIES AND TRADE-OFFS IN CLIMATE CHANGE RESPONSES

OECD
http://www.oecd.org

Beyond the climate change community and the United Nations Framework Convention on Climate Change (UNFCCC), how much awareness of climate change is there amongst development organisations? What steps have they taken in response to climate change? The development community and sectoral planners in several governments are increasingly asking how the future impacts of climate change can be included within development activities.

Recent reports commissioned by the World Bank and German and Norwegian aid organisations have looked at links between development assistance measures and climate change adaptation. Furthermore, ten international development agencies recently highlighted the importance of adaptation to climate change in achieving poverty alleviation.

In 2002, the Organisation for Economic Co-operation and Development (OECD) began the Development and Climate Change Project. The main objective was to explore possible synergies and trade-offs in "mainstreaming" responses to climate change. Mainstreaming in this context means integrating responses to climate change within normal development activities and plans. Case studies were conducted in Bangladesh, Egypt, Fiji, Nepal, Tanzania, and Uruguay. Each case study followed a framework designed to identify the links between adaptation to climate change and development activities. These included:

- a country-level overview of principal climate change impacts and vulnerabilities
- analyses of national plans and development assistance measures that affect vulnerable sectors and regions
- analyses at a regional/sectoral level of how climate change adaptation responses can be mainstreamed in particular development policies and projects.

Several findings emerged from this work. An analysis of official development assistance and loans to the six countries indicates that a significant amount of funding goes to sectors potentially affected by climatic risks. Between 1998 and 2000, the estimates range from several hundred million US dollars for Nepal and Tanzania to between one and two billion dollars for Egypt and Bangladesh. It is evident, therefore, that consideration of climatic risks (including climate change) should be central to development investments and projects.

Analysis of various national development plans and strategy papers for the six countries indicates that these documents generally give little consideration to the impacts of climate change. Furthermore, they often pay limited attention to current weather and climatic risks. In all cases, climate experts, sectoral planners and other stakeholders need to discuss different approaches to including adaptation to climate change in future development plans.

The discussion on mainstreaming responses to climate change is slowly changing. More emphasis is being given to whether and how adaptation to climate change should be included in development efforts. The significance of climate change, relative to other factors that affect development, will need to be evaluated on a case-by-case basis. In some cases, climate change impacts might only warrant attention over the medium to long term, and not be immediate priorities for development. However, there is likely to be a growing number of countries where climate change is of immediate concern.

INTERNATIONAL POLICY IN SUPPORTING ADAPTATION

International Institute for Environment and Development, London
http://www.iied.org/

The world is committed to a certain amount of human-induced climate change over the next few decades. Some negative impacts of climate change are inevitable. These impacts are likely to affect developing countries most severely. Developed countries and wealthier people in less developed countries may be able to cope with, or adapt to, these impacts. However, poor people across the world may require assistance to adapt to climate change and to offset its potentially unequal effects.

The United Nations Framework Convention on Climate Change (UNFCCC) came into effect in 1994 with the objective of reducing the rate of human-induced climate change through mitigation and adaptation. The "rich" countries, listed by the UNFCCC, have all accepted their obligation to assist poor countries to adapt to climate change, particularly small island states and least developed countries (LDCs). The Seventh Conference of Parties of the UNFCCC, held in Marrakech, Morocco, in 2001, created several new funds specifically for this purpose. The LDCs also developed guidelines for carrying out National Adaptation Plans of Action (NAPAs) to identify and prioritise adaptation actions in each country. These new funds include:

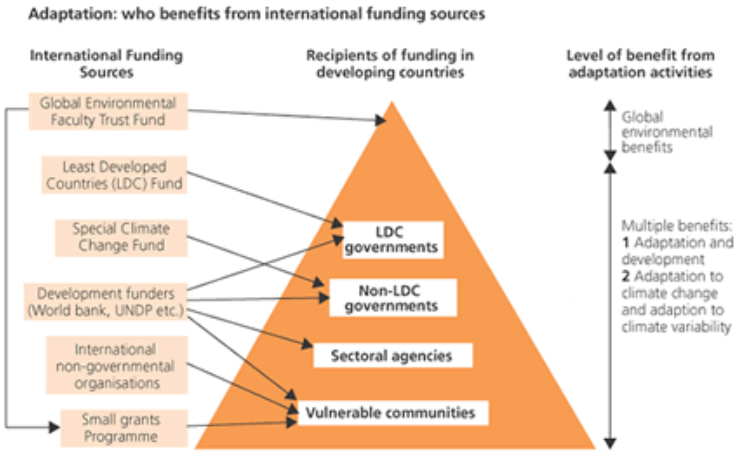
- Least Developed Countries Fund to support LDCs in carrying out their respective NAPAs
- Special Climate Change Fund to assist all developing countries in adaptation and mitigation
- Adaptation Fund under the Kyoto Protocol to assist all developing countries in carrying out adaptation measures.

So far, only the Least Developed Countries Fund is operational. In addition to these "Marrakech Funds", the Global Environment Facility (GEF) also provides funding for climate change activities, as part of the UNFCCC. While most funding for climate change over the last decade has been for mitigation, the GEF has recently set up a special fund for adaptation in developing countries, worth US$ 50 million over three years. However, one barrier to using these funds is the GEF rules, which state that they can only be used for the "incremental costs of global benefits". While it is relatively easy to calculate the costs of global benefits arising from mitigation projects, it is more difficult to do so for adaptation projects (as benefits are usually local rather than global).

UNFCCC funds are likely to form a relatively small part of the financial assistance that developing countries will need to adapt to climate change. It is therefore useful to distinguish between adaptation actions and international funding support. Adaptation will have to be done by the vulnerable communities, sectors and countries themselves, with whatever resources they can provide. International funding support for adaptation in developing countries is the responsibility of the UNFCCC and its associated funds.

Most adaptation in developing countries will need to be done as part of normal development activities. These will probably come out of existing development assistance funding, including official development assistance. Other funding may be available through bilateral and multilateral funding agencies and through non-governmental organisations, both national and international, as illustrated in the diagram (below).

A key challenge will be to find ways in which overseas development assistance and UNFCCC funds can be complementary, rather than repeating each other's activities. This process has only just begun and needs to be accelerated if developing countries (and their poorest communities) are to be assisted effectively in adapting to climate change in the near future.


Adaptation: who benefits from international funding sources
International Funding Sources
Recipients of funding in developing countries
Level of benefit from adaptation activities
Global Environmental Faculty Trust Fund
Least Developed Countries (LDC) Fund
Special Climate Change Fund
Development funders (World bank, UNDP etc.)
International non-governmental organisations
Small grants Programme
LDC governments
Non-LDC governments
Sectoral agencies
Vulnerable communities
Global environmental benefits
Multiple benefits:
1 Adaptation and development
2 Adaptation to climate change and adaption to climate variability

RESPONDING TO DROUGHT AND FOOD INSECURITY

Institute of Development Studies
http://www.ids.ac.uk/index.

Science cannot predict with certainty how future climate change will affect food security. Around 800 million people are currently undernourished, and this number will probably grow as our climate changes. How will the most vulnerable households and countries cope, when they are likely to be the most seriously affected and have the least resources to adapt?

Climate change is not necessarily all bad. The consensus of scientific opinion suggests that agricultural land may be gained in higher latitudes that are presently too cold for cultivation, if relatively small temperature increases are experienced. Overall, world food production may even increase because of global warming. However, this growth is likely to benefit large surplus producers in North America and northern Europe the most.

These potential benefits will also mask the severe problems poorer regions are likely to experience. Africa may be worst affected with losses of arable land and declines in rainfall reducing the length of growing seasons. This will intensify food insecurity in a region where crop production per capita is already declining and population growth will double the demand for food within the next 30 years. It may also create further dependency on overseas food supplies.

Climate change is not only about global warming but also changes in the frequency and magnitude of extreme weather events. Changes may occur in the frequency and severity of El Niño Southern Oscillation events, such as prolonged droughts and heavier monsoons; these have been fairly closely correlated with weather-related famines in the Horn of Africa (Djibouti, Eritrea, Ethiopia, Somalia including Somaliland, Sudan) for at least the past 200 years. There is also uncertainty about interactions between gradual and abrupt changes. A combination of slow climatic changes and increasing frequency of sudden shocks could trigger much larger and more frequent harvest collapses than countries can cope with.

Projections from increasingly sophisticated climate models for the global number of undernourished people by 2060 vary widely, ranging from 641 million to as many as 2.1 billion.

The uncertainty associated with predicting the impacts of climate change on food security are increased by:

- future technological, adaptive or political responses to global warming
- contrasting models for economic growth rates
- trends in urbanisation
- developments in global governance.

What can be done? Advances in technology - including, controversially, biotechnology - could transform agriculture. Alternatively, rural-urban migration or livelihood diversification within rural areas could reduce dependence on rain-fed agriculture, which is extremely sensitive to climate change.

Adaptation strategies can offset some of the consequences of climate change, and are already being used by people living in marginal regions. Examples include crop and livelihood diversification. Many risk management measures could have an immediate positive effect on hunger, regardless of climate change. A simulation model for Mali, where temperatures are projected to rise by 1°C - 2.75°C by 2030, anticipates cereal harvests falling by up to 19%. As a consequence, this will result in doubling the incidence of undernutrition from 34% to 64-70%. However, this simulation also demonstrated that, if appropriate policy and agricultural adaptations

were implemented now, hunger could decline from 34% to 21% of the population. This would require strong governance and considerable finance.
Action is needed at all levels to strengthen coping systems and reduce exposure to risk. Disaster planning will be needed to cope with the aftermath of unpredictable extreme weather events, but slower changes to weather patterns offer more opportunities to introduce risk reduction and risk management strategies. The economic cost of adaptation is high and those most affected by climate change can least afford it - the poorest and most vulnerable countries urgently need technical and financial support. But climate change could also affect international relationships.

ADAPTING TO CLIMATE CHANGE – HOW DO POOR PEOPLE COPE?

Institute of Development Studies, http://www.id21.org/society/index.html

Climate change will increase the gaps between developed and developing countries, in terms of wealth, health and food security. This will make achieving goals to reduce poverty more difficult. Poor people with few assets cannot easily recover from climate disasters or change how they make their living. They rely heavily on agriculture, fisheries, rivers and forests. These resources could change drastically with climate change, making these groups much more vulnerable than wealthier people. Additional factors, such as health problems and unsafe housing, make poor people even more vulnerable.

Research by Practical Action in the UK shows that efforts to reduce poverty can also help people to adapt to climate change. Climate change increases poverty because it can cause major changes to natural resources, which many poor people rely upon for food and income. The threats from climate change include large natural disasters and the risks from slower changes to the climate. International programmes to reduce climate change are important, for example the Kyoto negotiations to cut greenhouse gas emissions. However, adaptation requires governments to support local programmes and provide poor communities with the information and skills they need to plan for changes.

Many countries have begun to develop National Adaptation Plans of Action. These identify priorities for action and then plan for impacts affecting a country's most vulnerable areas, livelihood sectors and groups. For example, they might identify flooding as a priority, in coastal areas and plan for impacts on fisheries and fishermen.

Local programmes must:

- train people to make use of new information, technology and infrastructure
- help people to expand the ways they make a living, and rely less on one strategy that may be lost due to climate change
- combine poverty reduction activities with natural resources management and disaster risk management programmes. This will help create practical solutions that are developed locally.

Industrialised countries are largely responsible for climate change but people in developing countries are most affected. People in developed nations are, to a large extent, protected from climate change and natural disasters by their governments, insurance and wealth. Developed nations are therefore responsible for reducing the effects of climate change, compensating poor countries for the damage they suffer because of climate change and for the costs of adaptation.

- Adapting to climate change must be a part of all development policies, including the Millennium Development Goals.

- Adaptation should not be planned and financed as a separate policy or programme. The most effective way to adapt is to reduce poverty and help people to lessen their vulnerability to climate disasters and change.
- All project risk assessments should include climate change information and ensure that their interventions are 'climate-proof'. For example, new enterprises and housing developments should be assessed for risk from climate change.

Source(s):
'Just One Planet: Poverty, Justice and Climate Change' Intermediate Technology Publications Limited: Rugby, by D. Mark Smith, 2006; **id21 Research Highlight:** 9 January 2007

CLIMATE CHANGE AND THE WORLD BANK

http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT

Climate change directly affects the World Bank Group's mission of eradicating poverty. The World Bank has already started to address these concerns by integrating comprehensive climate risk management into development planning, programs, and projects.

The World Bank has identified the following key development areas directly affected by climate change:

Human health, Water supply and sanitation, Energy, Transport, Industry, mining and construction, Trade and tourism, Agriculture, forestry, and fisheries, Environmental protection, and Disaster management

(*Source: Managing Climate Risk: Integrating Adaptation into World Bank Group Operations)*

Climate change impacts on rural poor and their livelihoods

Climate change will have three main impacts on rural poor and their livelihoods: increase environmental risks, reduce livelihoods opportunities, and in consequence, stress existing social institutions. Its effect will occur through hazards and mechanisms that may be historically familiar, and for which the rural poor have often developed a rich repertoire of strategies and adaption practices. To strengthen the adaptive capacity of the rural poor, therefore, governments and other external actors need to strengthen and take advantage of already existing strategies that many households and social groups use collectively or singly. Examining the environmental risks that rural populations have historically faced, their cultural responses to these risks, and the institutional configurations that facilitate individual and collective adaptation strategies is therefore a fruitful area of inquiry and policy analysis for generating effective coordination with external interventions.

The Role of Local Institutions in Adaptation to Climate Change

The responses of local institutions to climate change in developing countries will be a key part of the global response to both adaptation and mitigation. Information on how and under which conditions local institutions can help reduce climate change-related vulnerability, enhance adaptive capacity, and promote sustainable livelihoods through more effective development policies and programs is currently sparse. Understanding how local institutions respond will be critical to producing effective policy responses which effectively mobilize and assist local communities.

All adaptation practices occur in institutionally rich contexts, and the success of adaptation depends on specific institutional arrangements. Local institutions are therefore necessary enablers of the capacity of households and social groups to deploy specific adaptation practices, and without them rural poor will find it far costlier to adapt in ways relevant to their needs. The framework proposed in this discussion forum suggests five major classes of adaptation practices that are available to the rural poor in varying measures depending on their social networks, access to resources, and asset portfolios: mobility, storage, diversification, communal pooling, and exchange. Given the importance of institutions to adaptation, it is critical to establish how different kinds of institutions reinforce particular combinations of adaptation practices. External interventions can reinforce livelihoods practices and local rural institutions by supplying four types of supports: informational, technological, financial, and leadership that reduces the costs of collective action. The framework also suggests that local institutions in the public, civic, and

private sector are an appropriate mechanism to channel external inputs that strengthen the adaptation practices of the rural poor.

Institutions and Livelihoods

Institutions are humanly created formal and informal mechanisms that shape social and individual expectations, interactions, and behavior. They can be classified as falling into public (bureaucratic administrative units, and elected local governments), civic (membership and cooperative organizations), and private sectors (service and business organizations) (Uphoff and Buck 2007: 47). Understanding how local institutions and their organizational forms shape the adaptation practices of the rural poor, is important to craft external interventions that strengthen the adaptive capacity of the rural poor. Livelihoods comprise the capabilities and material and social assets necessary for a means of living (Chambers and Conway 1992). A sustainable livelihood includes the idea of coping with and recovery from external stresses so as to maintain or enhance existing capabilities and assets. The maintenance of capacities over time, and the conservation of the resource base for resource dependent populations, are also central to the definition of sustainable livelihoods *(Ashley and Carney 1999, Norton and Foster 2001).*

South Asia and Climate Change

Climate change is no longer an issue for the distant future. Climate change is already taking place, and the South Asian countries, particularly the poorest people, are most at risk. The impacts of higher temperatures, more variable precipitation, more extreme weather events, and sea level rise are felt in South Asia and will continue to intensify.

These changes are already having major impacts on the economic performance of South Asian countries and on the lives and livelihoods of millions of poor people. The impacts result not only from gradual changes in temperature and sea level but also, in particular, from increased climate variability and extremes, including more intense floods, droughts, and storms.

The Intergovernmental Panel on Climate Change fourth Assessment report provided specific information for South Asia region concerning the nature of future impacts. Some future impacts include,

• Glacier melting in the Himalayas is projected to increase flooding and will affect water resources within the next two to three decades.
• Climate change will compound the pressures on natural resources and the environment due to rapid urbanization, industrialization, and economic development.
• Crop yields could decrease up to 30% in South Asia by the mid-21st century.
• Mortality due to diarrhea primarily associated with floods and droughts will rise in South Asia.
• Sea-level rise will exacerbate inundation, storm surge, erosion and other coastal hazards.

Impact on South Asia's poor

The consequences of such environmental changes include:

• decreased water availability and water quality in many arid and semiarid regions
• an increased risk of floods and droughts in many regions
• reduction in water regulation in mountain habitats
• decreases in reliability of hydropower and biomass production
• increased incidence of waterborne diseases such as malaria, dengue, and cholera
• increased damages and deaths caused by extreme weather events
• decreased agricultural productivity
• adverse impacts on fisheries
• adverse effects on many ecological systems

As a result of these changes, climate change could hamper the achievement of many of the Millennium Development Goals (MDGs), including those on poverty eradication, child mortality, malaria, and other diseases, and environmental sustainability.

Much of this damage would come in the form of severe economic shocks. In addition, the impacts of climate change will exacerbate existing social and environmental problems and lead to migration within and across national borders.

In sum, climate change is clearly not just an environmental issue but one with severe socioeconomic implications in South Asia.

(*Source: Managing Climate Risk: Integrating Adaptation into World Bank Group Operations*)

A DISCUSSION ON CLIMATE CHANGE AND FOOD SECURITY IN ASIA

SOLEX (Solution exchange) *http://www.solutionexchange-un.net.in*
Climate Change and Food Security – Experiences

Dear Members,

Though there has been occasional debate on global warming and climate change for the past couple of years, some of the recent phenomena across the globe have now confirmed that climate change is a stark reality. Key findings of the Inter-governmental Panel on Climate Change (IPCC) showed that this has had direct effect on animals, plants and water and the overall scene is a scary one. For example, Times of India February 3 2007 says that a one meter sea level rise would submerge 576,400 ha of land in India. This would displace about 7.1 million people - says a study by ADB. Rice yields in India could fall by 15-42% and wheat yields by 3.4%. Net agricultural revenues would decline by 12.3% if the temperatures change by 20^0C and rainfall by 7%. Fall in production alone can push GDP down by 1.8% - 3.4%. If total impact of climate change is considered then as much as 9% of the GDP of developing countries, like India, could be wiped out. India stands to lose 125 million tonnes (or 18%) of its rainfed cereal production according to the International Institute for Applied Systems Analysis, Austria.

AME had conducted farmers' interview to gather their perceptions on the effects of climate change on agriculture and livelihood in Mahaboobnagar, Raichur and Bijapur districts and some of the comments read like this:

Temperature has increased now and rainfall has reduced. The number of rainy days have also decreased. We are receiving less amount of rainfall now. Sometimes, the monsoon is delayed and sometimes, we receive early. Summers have become longer with strong sunlight and hot winds blowing. The winter season has become very shorter. The rains are not enough for the crops. It becomes difficult for us to step out during this time. These changes have started happening since only past couple of years. We work longer hours and more intensively, for reduced yields. Now cropping pattern has very much changed. Farmers are not even going for border and intercropping. Paddy, Minor millets, some vegetables are not grown due to climatic changes. We have shifted to cultivation of Sunflower from Safflower. We were growing paddy in low-lying areas, not now. Cotton is another crop, which now nobody grows. Foxtail millet now no body grows. Local Groundnut is also absconding. The yield has reduced by about 30%, before we used to get 12 bags but now only 7 to 8 bags.

Already 70% odd farming population dependent on rain fed agriculture are working very hard to make a living out of highly stressed-out natural resources like land and water. The climate change phenomena, as outlined above, will aggravate the situation, wherein, the concerns for future food security grow manifold. I would like the members to dwell on the following critical issues and share their experiences.

1. Whether farmers elsewhere also registered similar kind of experience of climate change on crop, livestock, water and biodiversity - critically affecting food security and any study or reports available?

2. Suggest ways of bringing the 'practitioners' (farmers), the 'facilitators' (the Government) and the 'enablers' (development agencies) to address these stupendous challenges?

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Bangalore

Thakur Dutt Sharma, Himachal Foundation of India, Dharmshala

This is a very crucial issue for food security. We feel, Farmers, almost, everywhere must have been getting similar kind of experiences of climate change on crop, livestock, water and biodiversity - and that definitely critically affect food security. Though no study or any reports available so far - as this is a relatively new phenomenon - we have already seen its impact in Himachal Pradesh too. There are erratic climate behaviour for everyone to see. For example, the production of apple has gone down due to sudden snowfall in the ripening months of apple. The rainfall during the flowering season has led to reduction in the number of fruits per tree. Therefore, farmer's income has been going down considerably because of these adverse effects. We need to have more intensive studies to assess the exact impact on weather pattern as well as crop performance. Similarly, the water and biodiversity study is necessary to understand the real effect of climate change on those aspects.

The answer to the question, we feel are difficult to find out at individual farmer's level, as these are global issue. However, widespread awareness is necessary so that whatever we do should not add to the problem. In addition, we must urgently give attention to see how best and how earliest we could cope with such changing circumstances. One of the solutions for HP, that comes to our mind immediately, is that every household should be provided the cooking gas connection at the discounted rate so that the wood is not destroyed and used for cooking purposes and forest resources are maintained. As aptly said it's a stupendous challenge, where farmers, the Government and development agencies must work to devise strategies together to address these issues.

M. K. Dasgupta, Visva Bharati Santiniketan, Bolpur

Global Climate Change is not only nearer home but also inside your home. Some of the Sundarbans islands - the world's largest delta and mangrove forest, threatening an ecological disaster for the Bengal basin region - have been inundated and lost, forcing people to leave their homesteads. The BBC report (http://news.bbc.co.uk/2/hi/south_asia/3102948.stm) has shown how the sea is steadily eating into the Sundarbans. Referring to satellite imagery it reports how the sea level in the Sundarbans has risen at an average rate of 3.14 centimeters a year over the past two decades - much higher than the global average of two millimeters a year.

In the past two decades, four islands - Bedford, Lohachara, Kabasgadi and Suparibhanga - have sunk into the sea and 6,000 families have been made homeless. Two other islands - Ghoramara and Mousuni - are fast going under. Sagar, the biggest island in the Sundarbans, has already lost 30 sq. km. The entire island system is faced with a rapid loss of land area and embankments, flooding and salinisation of drinking water. Many residents are moving out; these islands are becoming uninhabitable.

In the Sundarbans, increasing pressure of land also threatens the existence of tiger already facing extinction. The diverse marine life - river sharks, red crabs, shrimps, snakes - all uniquely adapted to the saline water - will be harmed, drastically affecting the food chain and fishing industry. Scientists say that the Sundarbans, South Asia's largest "carbon sink" - which mops up carbon dioxide - must survive to help prevent global warming.

Pankaj Kumar S., United Nations Development Programme (UNDP), New Delhi

A week back, I attended a meeting where some scientists from Columbia University and the Indian Meteorology Department presented the impact of climate variability on various aspects of human development and climate change.

For India, the overall forecast seems lesser number of rainy days, greater precipitation in those rainy days- keeping the overall rainfall the same. They also predict an increase in earth's surface temperature and an overall increase in mean ambient temperature of about 3 to 4 degrees in the next 20 years. This has grave implications for water resources management (water storage structure design, siting, etc.), crop growth, especially of sensitive crops, and hence livelihoods, and on drinking water supply, sanitation, disease vectors, etc.

The presenters suggested building a "risk screen" to evaluate all projects, so that preparation for climate variability is built in. They also emphasized that the approach to climate variability should not begin with climate, but with society. We also need to consider other changes, which are happening in our society, such as rapid urbanization, and the uncertainties that factors other than climate variability are throwing at us.

As far as the impact on crops is concerned, possible steps could be as follows:

- Develop climate variability related Insurance packages.
- Integrate variability in rainfall patterns into designs for water harvesting structures, especially for irrigation.

The soil-vegetation-moisture matrix will change with a change in rainfall and temperature. This may mean that the location of crops may change. For example, crops growing in climate type "A" today may be able to grow in places, which earlier had climate type "B", but due to climate variability experience climate type "A+". However, this would mean preservation of crop varieties, documentation of their specific soil-moisture-climate requirements, and adapting it for new soil types and other conditions. At least we should start such documentation as soon as possible.

Mahtab S. Bamji, Dangoria Charitable Trust, Hyderabad

This is a very important issue requiring not just debate but research and preparation of a road map to guide the farmers. Let us accept that global warming is taking place and its adverse effects on crops is going to be a reality. With the existing knowledge what can be done to ensure food security? Future research to develop temperature and drought resistant varieties should be the immediate research agenda.

K. V. Peter, Kerala Agricultural University, Thrissur

I have just returned from Attapady in Palghat District of Kerala, where the Indo-Japanese project Attappady Hills Area Development Society (http://www.ahads.org/) (AHADS) is located. The AHADS was established to provide livelihood security to tribals and also to bring back green cover to the denuded hills. It is only 30 km away from Silent Valley the evergreen forests. The month is June when in normal course, torrential rain is expected. The Agricultural officer tells me that so far only 3 rainy days were witnessed. Felling of trees and consequent soil erosion raised rhyzosphere temperature. The result is barren and naked hills which otherwise would have provided green cover.

Recently I also visited Vythiri and Kalpetta in Wayanad District of Kerala known for torrential rain and cold climate. People used to wear woolen sweaters during November-February. It is quite warm and youngsters would not have seen clothing called sweater. I sweat out during December in Kalpetta, the temperature rise you can easily feel.

I will attribute all this to felling of trees without replanting. River sand mining is also another culprit. Tree planting should be a movement of people to green the barren hills of Western Ghats. New materials to replace sand should be discovered. Now river sand has become gold. When sand is

mined from rivers, there is a chain reaction to fill up the void. Soil erosion, land slide, change of rivulets and ultimately dead soils for agriculture are all resultants of a greedy human action.

P. K. Thampan, Peekay Tree Crops Development Foundation, Kochi

The radiatively active or trace gases present in the atmosphere in minute quantities are known by the name 'green house gases'. Like a one-way filter, these gases let the short wave length radiation in sunlight pass through them, but absorb most of the long wave thermal radiation reflected from the earth's surface. This phenomenon is named the 'green house effect'. Increasing concentration of these gases disturbs earth's radiative balance causing significant increase in the average temperature, which according to recent findings is already under way. Among the green house gases carbon dioxide is by far the most important one and contributes about half of the anthropogenic green house forcing. Others in the group are methane, nitrous oxide, nitrogen oxides, carbon monoxide, ground level ozone, chlorofluorocarbons etc.

Deforestation is the primary source of anthropogenic emission of carbon dioxide and other green house gases. The climate forcing caused by the emission of these gases could be modulated by promoting tree farming as trees form the major terrestrial sink of carbon. Trees assimilate more carbon dioxide during daytime in the process of photosynthesis than they release in darkness through respiration. The excess carbon dioxide assimilated is sequestered as stored carbon in the woody biomass.

In India, around 130 million ha of land are regarded as degraded. This covers 85 million ha of agricultural land suffering from various degrees of degradation and 45 million ha of denuded forestlands. One of the causes for the denudation of forestlands is the uncontrolled extraction of firewood mostly for meeting the energy needs for cooking and heating in households. Besides causing ecological disturbances, deforestation leads to the elimination of the major terrestrial sink of carbon dioxide and other atmospheric pollutants thereby contributing to the increasing concentration of green house gases in the atmosphere and the associated climatic changes. To offset this development, the most viable approach is to establish firewood and industrial plantations on the denuded forest areas as well as on the degraded agricultural lands and to promote agro forestry in farm-households and agricultural lands. Agro forestry denotes the deliberate planting of tree species in association with arable crops with or without the integration of livestock components in the system.

Properly established mixed tree plantations are expected to yield around 15 tons of biomass per hectare per year, which is equivalent to 6.75 tons of carbon sequestered in the tree parts. In addition to the sequestered carbon in the biomass, the carbon storage of soil under trees is also expected to increase. With a tropical climate, the annual accretion to soil carbon stock may not be much, but a reasonable average is 0.5 tons per hectare.

Thus, the annual increase in carbon storage in one hectare of land under a dense tree cover could be 7.25 tons until the trees attain maturity. At this rate, organized tree planting to cover six million hectares of denuded forestlands can contain the net carbon release linked to deforestation in India. However, when trees become over mature, they may become net emitters of carbon dioxide, as their absorption in photosynthesis is less than the quantity emitted in respiration. As such, trees are to be harvested periodically before they become over mature followed by fresh planting in an equal extent of new area and also replanting the cleared area, thus covering double the area cleared at each time.

Devendra Sahai, Diverse Ecological Enhancement Programme (DEEP), New Delhi

I would like to raise the issue of: "the effect of Population Overload on the Eco System and the finite (now dwindling and polluting) Resources of the World, in particular of the Developing countries", the Sub Continent and Sub Saharan Africa.

It is absolutely essential to have an optimal, sustainable balance between Population, Resources and Environment in any country, indeed in the World as a whole. So long as the Population is within the sustaining capacity of the country's Eco System and it's Resources, all the three are in a healthy condition on a long term basis. New Zealand, Canada and the Scandinavian countries are prime examples.

Once the Population load exceeds the sustaining capacity of the Environment and the Resources of the country, the latter two are subjected to degradation and pollution leading to their eventual destruction and elimination. The once clean, green, pristine land is turned into a wasteland, incapable of sustaining life!

Since 1947, India's Population has exploded from 30 Crores to 113 Crores and is continuing to rise. The result is evident, particularly to those who have witnessed the green, rich and well watered Eco System and the abundant resources of India in 1947. The denudation of our forests and grasslands due to population pressure has made a major contribution to temperature rise and water shortage.

I would like to share a paper on "Stabilize Population to Save the World" (http://www.solutionexchange-un.net.in/food/cr/res180607.doc) I strongly believe that if we stabilize our population, the developmental inputs have a good chance of bringing matters back under control.

R. K. Sood, Centre for Health Promotion, Palampur

Yes, I agree with Thakur Dutt Sharma. The increase in prices and scarcity/difficult availability of cooking gas in recent years has led to increased consumption of firewood as fuel in rural areas.

Moreover, the deforestation is going on at alarming rates with hide projects without Environment Impact Assessment (EIA), pressures of timber need for construction activity going on at high pace and incomplete implementation of ban on felling of trees in remote areas. The hill state has only 25% forest cover (State of the forests report 2003) against the required norm of 33% of national forest policy. Climate change also threatens the existence of water bodies and glaciers and lack of sustainable water sources will not only threaten food security but also more disease due to water scarcity. Tourism could take a beating with hot climate and the niche of the mountains will be lost.

The answer lies in sustainable development through natural resource based livelihoods, so that people have an economic stake in conservation of natural resources. This also requires control of the resources by the local people- strengthening local self-governance and accountability. For detailed discussion on the issues visit us a www.navrachna.org.

Pradeep Mohapatra, Udyama, Orissa

I work at Udyama, one of the non-profit development and humanitarian organization which has the mandate in addressing common issues - food, water, environment and livelihood as right to protection and promotion, child health, education and nutrition as right to development and disaster management, adaptation to climate change and to combating desertification as right to participation with community as consortium of NGOs, CBOs, PRIs.

Western Orissa is a region of chronic food shortage, recurrent droughts, flash floods, deterioration in socioeconomic conditions and collapse of traditional water harvesting structures. This forces large number of people from the area to migrate from the region in search of livelihoods. Building on lessons learnt from a CARE supported Community Based Drought Rehabilitation Programme a group of CBO's from Bolangir district in Western Orissa came together to form a consortium that used Sustainable Livelihood Approach (SLA) to design and implement the Risk Reduction and Livelihood programme (http://www.livelihoods.org/post/orissaconsortium-postit.html) in Western Orissa.
Water Initiatives Orissa is a seven-year old campaign, which draws strength from civil society organizations, grassroots communities, academicians and others who are determined to work on water, disasters and climate change issues. I would like to share their appeal on the occasion of "World day to combat desertification and drought (http://www.solutionexchange-un.net.in/food/cr/res18060701.doc) (17th June)".

From the Appeal:

"Time we take climate change seriously, Orissa may suffer from severe food insecurity, if desertification is not reversed. Even with increase in irrigation potential, and other chemical and fertilizer inputs average annual production of paddy, Pulses, Oilseeds, Potato, Onion and other vegetables have decreased by 6.8, 56.4, 44, 20.7, 14.4 and 24.8 percent respectively in a decade. At the same time land degradation has been more rapid."

Please find below related documents on the discussion issue:

Climate Change and Water Resources (http://www.solutionexchange-un.net.in/food/cr/res18060702.pdf) – Water Aid

Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability (http://www.solutionexchange-un.net.in/food/cr/res18060703.pdf) - Working Group II Contribution to the Intergovernmental Panel on Climate Change. Fourth Assessment Report

Twelfth Session of the Conference of the Parties to the UN Framework (http://www.solutionexchange-un.net.in/food/cr/res18060704.pdf) Convention on Climate Change and Second Meeting of the Parties to the Kyoto Protocol

Anupam Paul, Agriculture Training Centre, Fulia (response 1)

Thank you very much for raising a burning issue like climate change and food security. Really it is a major concern for the Governments and the farmers. Owing to aggressive industrial agricultural growth over the last thirty years or so there is a vast erosion of traditional crop varieties, which had the ability to stand the vagaries of seasons. Ground water is depleting fast with minimum recharging. Again, due to unlimited water uptake arsenic in drinking water poses a great threat to large part of West Bengal. Water requiring crops have replaced water prudent crops like jower, bazra and other millets. In some parts of West Bengal, farmers are growing kharrif paddy through lifting of ground water and jute is being retted by this destructive process. There is no way out. Rainfall is scanty and erratic. Institutional research is still in its embryonic stage.
(Contd)

However, time has come to find out a suitable way for our future food security.

- Encouragement of farmers to grow water prudent crops
- To grow folk rice having less water requirement or to search for suitable varieties
- Mulching through cover crops
- Eco friendly research to combat this water stress but not through transgenics which will invite a grave ecological devastation in near future

- Research on traditional knowledge system
- Massive awareness campaign regarding this impending environmental disaster
- All the Government farms should follow these so that the near-by farmers are encouraged to adopt the technology

Ardhendu S. Chatterjee, Development Research Communication and Services Centre (DRCSC), Kolkata (response 1)

You have raised an important issue, but the answers are multi level and multi dimensional and hard to summarize. Rainfall is becoming irregular and soil erosion is accelerating; droughts are more frequent, biodiversity is declining rapidly, a common experience, whether and to what extent this is due to/or linked to climate change can always be debated.

We, development workers, should realise that climate change itself is largely a result of many wrong agricultural/Natural Resource Management (NRM) practices introduced in our country and many other developing countries in the name of development (especially reducing poverty and hunger). Climate Change is mostly result of poor design and management.

- Mechanisation of tilling, irrigation etc on a large scale has made our farms dependent on exothermic energy (mostly non-renewable) resulting in Green House Gas (GHG) emission.
- Use of subsidised chemical fertiliser (mainly Nitrogen) has polluted air, water, soil. Moreover, the manufacture of these fertilisers requires massive amounts of energy and water.
- Forests have been affected to some extent by over harvesting of firewood, timber and due to shortened cycles of slash and burn agriculture (the poor as always are blamed for this). Far larger areas of natural forest have been destroyed by large dams, mines, power projects, roads, commercial crop/tree plantations, urban expansion etc
- Much of our forests and wetlands have also been converted to monoculture, input intensive farmlands, often with political patronage.
- Destruction of coastal mangroves by tourism projects, coastal railways and roads and by intensive shrimp farming has increased vulnerability to floods and cyclones
- While we complain about carbon dioxide, nitrogen oxide emissions of industrialised country there is much we can do to make agriculture pro-poor, and pro basic need; such bio intensive and integrated farm management systems can reduce the possibility of climate change
- Much of our problems come from the fact that we have built on our weaknesses: fossil fuel, agrochemicals, machineries, groundwater etc; all that we have in short supply. Either due to ignorance or deliberate plan we make ourselves more and more dependent on a few short term profit seeking trans-national corporations who threaten food sovereignty
- We can build on what we, in the tropics, have in abundance; e.g. sunlight, diversity of genes, species and ecosystems, indigenous knowledge and ethics of earth care
- If we build sustainable farms, agro forests, orchards we shall contribute less to GHG and make our farms more resilient to climate change.

If many are interested we can discuss specifics of what can be done to reduce vulnerabilities arising from climate change but cosmetic measures and symptom suppressing treatments will only accelerate our journey to 'disaster land'.

Gopi Ghosh, Food and Agriculture Organization of the United Nations (FAO), New Delhi

The Adaptation to climate change in agriculture, forestry and fisheries: Perspective, framework and priorities, (ftp://ftp.fao.org/docrep/fao/009/j9271e/j9271e.pdf) by FAO divides climate change impact roughly into two:

a) biophysical impacts consisting of physiological effects on crops, pasture, forests and livestock (quantity, quality); changes in land, soil and water resources (quantity, quality); increased weed

and pest challenges; shifts in spatial and temporal distribution of impacts; sea level rise, changes to ocean salinity; sea temperature rise causing fish to inhabit different ranges; and

b) socio-economic impacts i.e. decline in yield and production; reduced GDP from agriculture; fluctuations in world market prices; changes in geographical distribution of trade regimes; increased number of people at risk of hunger and food insecurity; migration and civil unrest.
Highlighting that considerable efforts are needed to prepare for climate-related impacts the document prescribes two main types of adaptation- autonomous and planned adaptation. Autonomous adaptation is the reaction of, for example, a farmer to changing precipitation patterns, in that s/he changes crops or uses different harvest and planting/sowing dates. Planned adaptation measures are conscious policy options or response strategies, often multi-sectoral in nature, aimed at altering the adaptive capacity of the agricultural system or facilitating specific adaptations. For example, deliberate crops selection and distribution strategies across different agri-climatic zones, substitution of new crops for old ones and resource substitution induced by scarcity.

Farm level analyses have shown that large reductions in adverse impacts from climate change are possible when adaptation is fully implemented. Short-term adjustments are seen as autonomous in the sense that no other sectors (e.g. policy, research etc.) are needed in their development and implementation. Long-term adaptations are major structural changes to overcome adversity such as changes in land-use to maximize yield under new conditions; application of new technologies; new land management techniques; and water-use efficiency related techniques. The major classes of adaptation cited are seasonal changes and sowing dates; different variety or species; water supply and irrigation system; other inputs (fertilizer, tillage methods, grain drying, other field operations); new crop varieties; forest fire management, promotion of agro forestry, adaptive forest management practices.

Accordingly, types of responses include reduction of food security risk; identifying present vulnerabilities; adjusting agricultural research priorities; protecting genetic resources and intellectual property rights; strengthening agricultural extension and communication systems; adjustment in commodity and trade policy; increased training and education etc. Among the key challenges will be to assist countries that are constrained by limited economic resources and infrastructure, low levels of technology, poor access to information and knowledge, inefficient institutions, and limited empowerment and access to resources.

In view of the above, a framework for climate change adaptation needs to be directed simultaneously along several interrelated lines:

Legal and institutional elements – decision-making, institutional mechanisms, legislation, implementing human right norms, tenure and ownership, regulatory tools, legal principles, governance and coordination arrangements, resource allocation, networking civil society

Policy and planning elements – risk assessment and monitoring, analysis, strategy formulation, sectoral measures

Livelihood elements – food security, hunger, poverty, non-discriminatory access

Cropping, livestock, forestry, fisheries and integrated farming system elements – food crops, cash crops, growing season, crop suitability, livestock fodder and grazing management, non-timber forest products, agro forestry, aquaculture, integrated crop-livestock, silvo-pastoral, water management, land use planning, soil fertility, soil organisms

Ecosystem elements – species composition, biodiversity, resilience, ecosystem goods and services

Linking climate change adaptation processes and technologies for promoting carbon sequestration, substitution of fossil fuels, promoting use of bio-energy.

Ardhendu S. Chatterjee, Development Research Communication and Services Centre (DRCSC), Kolkata (response 2)

My earlier response pointed out that climate change is caused also by the way we presently do farming (both in industrialised and developing economy) and to reduce GHGs we need to make farming both diversified, integrated and local need oriented (the opposite of what is being encouraged and subsidised by the majority of state institutions at present).

Some examples of what we can do:

At community level: Multi storey nutrition gardens with lots of food and fodder trees/shrubs, growing of roots and tubers to tide over periodic food grain shortages, group based small grain banks, seed banks of drought tolerant food and fodder plants as well as herbs/spices etc. Small scale water harvesting, compost making and agro forestry/mixed farming projects. Use of rice hull stove, and real bio gas units that can handle home, farm and market wastes; weeds such as water hyacinth, manure and urine from humans, pigs, goats etc. Promotion of conservation tillage/no-tillage farming; integrated rice duck fish azolla farming; coastal zone shrimp-coconut-rice integrated farming, upland area stabilised slash and burn rotational agriculture etc.

At village or micro-watershed level: Rejuvenation of wetlands, grasslands and degraded forests under community based management, introduction of large bio digesters that can handle industrial bio wastes such as bagasse, jute or cotton waste etc, promotion of solar driers, solar cookers and heaters, photovoltaic energy etc, strategic placement of catchment ponds and soil conservation structures etc. Generation of power from wind energy, rice hull and other bio mass fuelled generators. Conservation of indigenous plant and animal genetic material, protected from patent/IPR regime

At National level: Campaign in favour of sustainable growth models and against rapid urbanisation, conversion of food growing (high carrying capacity land) for non agricultural crops or industrial monocrop/energy plantations, subsidised fertiliser and water/energy supply for production of thirsty crops such as rice, sugarcane etc outside low lying regions and after the rainy season using pumped up groundwater.

Genuine poverty reduction does not need the destruction of common property resources, investments that empower primary producers and artisans can strengthen our economy against climate change, and reduce the possibilities of rapid environmental degradation.

B. L. Menaria, Centre for Sustainable Forest Management (SFM) and Forest Certification, Indian Institute of Forest Management, Bhopal

It seems obvious that any significant change in climate on a global scale should impact local agriculture, and therefore affect the world's food supply. Considerable study has gone into questions of just how farming might be affected in different regions, and by how much; and whether the net result may be harmful or beneficial, and to whom. Several uncertainties limit the accuracy of current projections. One relates to the degree of temperature increase and its geographic distribution.

Another pertains to the concomitant changes likely to occur in the precipitation patterns that determine the water supply to crops, and to the evaporative demand imposed on crops by the warmer climate. There is a further uncertainty regarding the physiological response of crops to enriched carbon dioxide in the atmosphere. The problem of predicting the future course of

agriculture in a changing world is compounded by the fundamental complexity of natural agricultural systems, and of the socioeconomic systems governing world food supply and demand.

Ramit Basu, United Nations Development Programme (UNDP), New Delhi

Thanks for raising such a pertinent issue. I would like to answer to the two questions raised by you -

I think the farming communities across the world are experiencing adverse weather conditions affecting crops and productivity. Especially those areas which are rain fed and do not have any other agricultural infrastructure to support them.

My personal experience was when I was working in Jharkhand and Bihar and was part of the food and livelihood security project implemented by Gene Campaign. Regular interaction with farmers revealed that they are experiencing situations like crop failure, wilting of crops etc. due to changes in climatic patterns over the last few years. Lesser rains caused lesser leaching as a result of which the soil texture and micronutrient composition has changed abruptly.

The situation was aggravated when they started growing high yielding variety crops without much knowledge of how to handle such crops and the fact that they required much higher inputs. Erratic rainfall pattern and seasonal floods made situation worse as crops were not able to withstand such phenomenon and hence caused great losses to these poor farming communities.

Addressing such challenges, we started making farmers realise the importance of traditional crops, which used to be the source of food for them for centuries. Such crops not only required low inputs but were also able to withstand climatic uncertainties like floods or droughts (as a result of climate change). (Debates on productivity can be challenged on grounds that survival and sustainability is the need of the hour and there can never be a choice of technology and means of production, which reaches the peak and then crumbles bringing communities to the verge of extinction.)

The Government, especially the agricultural extension machinery and development agencies should focus on helping communities strike a balance between the traditional and the modern practices (I mean 'organic farming' which is not modern certainly) so that not only we strengthen the soil and its productivity but also make crops and the agricultural biodiversity strong enough to stand the uncertainties of nature and still prove to be a source of food security.

We have been responsible for the global warming and associated climate change. Its we who have the answer to all such problems.

Anupam Paul, Agriculture Training Centre, Fulia (response 2)

Thanks to Mr. Basu for his keen observation on the loss of agro biodiversity due to introduction of industrial agriculture followed by climate change. However, he mentioned that there should a balance between modern and traditional agricultural practices. But to be precise, the aim of the industrial agricultural is to destroy our rich agro biodiversity and traditional knowledge systems. I beg to differ regarding his conception on modern agriculture and organic farming. The term modern is a relative one and to me, it is not a scientific term. However, green revolution technology (GRT) and the traditional agricultural practices-proven and tested over the centuries are two diverse thoughts. I do not see them matching with each other. There are a lot of scientific studies regarding the efficacy of organic farming and it can feed the world.

Of course, propaganda is going against such eco-friendly practices - which are based on some preconceived ideas and GRT. The science and the philosophy of organic farming cannot be explained in terms of industrial agriculture (read GRT) and current economic theory. For this one has to consult subjects like ecological economics, environmental economics and Senian economics (welfare economics) etc. But the proponents of mainstream agriculture choose to ignore these. To me the strategies of climate change mitigation may be found out through organic farming practices-, which are in more sync with the nature.

Jyotsna Bapat, Independent Consultant, New Delhi

Human beings have a unique way to respond to the changes in the environment that affect their food crops. While looking at the impact of sewage and wastewater usage on surrounding agricultural farms in Hyderabad's neighborhood areas I found something, which will be relevant to the question itself. When the open canal that carried sewage from the city to the Sewage treatment facility was constructed a few decades ago, there were 24x7 (waste) water supplies that the neighborhood farmers could not resist using. They used initially for their paddy but soon found that the high pH did not allow for the grain to form and so within two years most of them converted to growing para-grass that is used for animal feed. This gave rise to dairy farming along this canal.

The point I am making is human creativity and ingenuity will respond to climate change as it happens. Just as some areas will become 'dry', other will become 'wet' and a balance will get restored. This is not to undermine collective action and thinking to respond to climate change, but only to point out that panic and dooms day predictions are not a response to climate change issues

Raj Ganguly, GMED-USAID, Jaipur

It is high time we realize the possible impacts of agriculture on climate change or more precisely 'irreversible changes in nature'. We need to understand 'Agriculture' and its' transition to Agri-industry in last 100 yrs. The impacts of chemicalisation of agriculture in western world can be underlined- Refer 'Silent Spring' (http://www.nrdc.org/health/pesticides/hcarson.asp) by Rachel Carson (http://www.amazon.com/Silent-Spring-Rachel-Carson/dp/0618249060). Agriculture is a dynamic interaction between various biotic and abiotic elements e.g., soil, water, air, microbes, flora and fauna, and crop plants. Any disturbance in the natural balance may challenge crop productivity or cause environmental changes. The use of chemical fertilisers may help the crop productivity to recover from losses in the immediate future, but the permanent damages in soil health (loss of micro flora and fauna, increased salinity, disturbed C/N ratio etc) may create long-term problems. Soil is the central element of agriculture and unfortunately this has been treated just as a growing media in the industrial agriculture concepts, ignoring the microbiological and chemical interactions.

The agronomic principles of crop rotation, intercropping, mulching etc which helps in maintaining sound soil health gets ignored in agri-industry concept as the focus shifts from sustainability to 'only higher productivity'. However we should not ignore the contributions of modern agriculture technologies in irrigation e.g. drip, sprinkler, sub-soil, which helps in efficient crop production and minimises water losses besides maintaining healthy soil. The need is to encourage integrated agricultural systems which minimizes risks of climate change on agriculture, builds micro-climate in villages, ensures sustainability and caters to market requirements. For rain fed agriculture systems the risks of climate changes can be tackled by adopting following strategies:

Promoting farming system approach - i.e., integrating livestock, agriculture, horticulture and agro-forestry. This will create inputs (livestock manure, leaves for composting), minimise risks of crop failures, create biodiversity for water conservation thus building micro climate in the farm/villages,

produce additional products like fuel wood, milk/meat, honey, silk as additional revenue generation (counteracting poverty). Encouraging tree planting (Neem, other local trees) as border in the farm/villages can have multiple effects within 5-6 years.

- Identify local solutions/technologies including Indigenous Technology Knowledge - for plant growth, insect pest damage control, post harvest losses.
- Identify crop rotation cycles - Crops like Sesame which is a drought prone high value crop should be encouraged. Safflower also is a good choice. Seed development programme at village/community level can help isolate promising cultivars and mitigate challenges of climate change.

- Water conservation or 'Efficient use of water' should be the key strategy. Promotion of drip / sprinkler is the best but requires resource mobilisation at higher scale. Government efforts should be in this direction.

- Low cost technologies crop/variety selection, intercropping, green manuring, composting, and mulching can do wonders in this direction by not only conserving soil moisture but also increasing crop productivity and mitigating the challenges of climate change.

- Marketing: Incorporation of high value crops in the cropping system as per the market requirement e.g. herbs, medicinal plants - aloe vera; kalmegh, sesame, drumstick, citrus, pomegranate (to name a few - as fit in rainfed situations) should be encouraged with proper post harvest, processing and marketing back up.

The overall strategy as discussed above should be to understand and apply the principles of Agriculture as per local situations and not blindly adopting the Agro-industry concepts of relying on higher external inputs which may have serious repercussions on not only environment and further aggravate the challenges of climate change on Agriculture but also increase burden on the resource poor small farmers of rainfed areas. Key areas to focus should be - soil health, water conservation, farming system, local solutions, building micro-climate

FOCUS ON THE PACIFIC ISLANDS

National Institute of Water & Atmospheric Research, New Zealand (unpublished)
www.wwfpacific.org.fj

Many Pacific islands are extremely vulnerable to the impacts of climate change such as sea level rise. The Intergovernmental Panel on Climate Change predicts that sea levels will rise by between 0.09 and 0.88 metres by 2100 and continue rising after this. Higher sea levels will cause coastal flooding and have adverse effects on biodiversity, soils and water supplies. Pacific Islanders will be among the first people forced to adapt or ultimately relocate. The impacts will be felt for many generations because of the low adaptive capacity in these islands and high vulnerability to climate-related natural disasters.

Concerns about climatic change were first raised during the South Pacific Forum Leaders meeting in 1988. In 2000, the Pacific Framework on Climate Variability, Climate Change and Sea Level Rise was adopted. Local public pressure is now mounting for action on adaptation on many islands. There is growing community and government concern about the need to reduce vulnerability and manage the risks posed by extreme events and long-term change.

The Pacific Framework aims to promote action and strengthen partnerships at all levels. This will enable islanders to understand and respond to climate change and sea level rise. People and partnerships are at the centre of the process. This is reflected in the range of climate change programmes now underway. An example of this is a workshop held in 2004, organised by the Fiji Department of Environment in partnership with the World Wildlife Fund-Fiji climate change. This initiative aims to develop strategies that reduce the risks of climate change for people, such as building freshwater storage facilities. This is part of a regional initiative organised by the Canadian International Development Agency.

There are several critical research and information needs in Pacific Islands. These include:

- providing access to and maintaining fresh water supplies, which are threatened by contamination by rising sea levels
- protecting public health
- ensuring public safety in extreme events and protecting community infrastructure
- sustaining agriculture, by adapting to changing rainfall patterns and increasing salt content in soils
- sustaining tourism
- promoting wise use of marine and coastal resources, such as mangroves, coral reefs and fish stocks.

Although several adaptation programmes are in place, there remain considerable difficulties. Experience over the last two decades shows that while Pacific Islanders are receptive to assistance from outside, they know that they are responsible for designing impact and adaptation programmes within their communities. These must consider local cultures, traditions, and identify the factors likely to hold back the success of these programmes.

WORLD HUNGER ALLEVIATION THROUGH RESPONSE FARMING (WHARF)

http://www.responsefarming.org/welcome.html

WHARF is a scientific, educational and charitable trust, founded in 1984 in Davis, California. WHARF's mission is to extend "Response Farming" research and practice worldwide (wherever warranted). Support is welcomed from all who have an interest in reducing hunger and poverty among the World's rural poor, and in ending Slash & Burn Agriculture, the most pervasive destroyer of tropical forests and the wildlife which inhabit them. Your contribution may be in the form of a tax exempt gift, grant, or contract for research, training or consulting services.

WHARF/Response Farming origins and methodology

Response Farming springs from research on rainfall behavior and its predictability in a "cropping systems design" project in Kenya, sponsored by USDA/USAID. The methodology also includes crop yield estimation procedures developed earlier by Dr. J. Ian Stewart and colleagues at UC Davis, plus subsequent findings in global research on rainfall behavior sponsored by WHARF. At UCD, Stewart and colleagues pioneered studies of crop water requirements, crop capabilities to extract soil water when under stress, and crop yield responses to water deficits - and developed practical field methods of estimating these and related "water production functions" to guide improvement in water management for crop production. Findings were substantiated and broadened in coordinated field studies carried out by university research teams in four western states (CA, UT, CO, AZ).

In Kenya the project goal was to design sustainable cropping systems for low resource farmers in marginal rainfall zones, characterized by great seasonal rainfall variability, uncertainty, and recurrent drought. Despite the complete swing from large scale hi-tech irrigated farming in the western USA, to small scale lo-tech rainfed farming in Kenya, crop interactions with the soil-water-weather environment held to the same principles, and Western USA estimation procedures worked equally well in Africa. However, great rainfall variation soon made it clear that no fixed set of cropping procedures could both minimize the crop failure rate in poor seasons and produce above average yields to lift the family from utter poverty in good seasons.

A need for flexibility in crop management implied a need also for some useful level of predictability of season rains. The selected predictor was the date of onset of the rainy season and research was focused on ways cropping season rainfall behavior (amount, duration, daily intensity, etc), or rain behavior in any particularly sensitive crop growth stage, changes with the date of onset of the rains. In other words, for any given crop(s), how do localized rainfall probabilities differ between seasons in which onset of the rains is "late" versus seasons when onset is "early"? Do probabilities differ enough to warrant changes in how farmers proceed in late vs. early seasons? If so, flexible or "opportunity cropping" can greatly reduce risks from insufficient seasonal rain, or its duration, or aberrant behavior in critical crop growth stages.

The answer is yes in most locations enjoying monsoonal or Mediterranean type rainfall regimes, i.e. the globe girdling belt termed the tropics and semi-tropics, plus all Mediterranean countries, California, Western Australia, South Africa's Capetown area, etc. This means Response Farming is applicable through allthe developing world and certain areas located in the more advanced countries. Response Farming analyses require localized daily rainfall records for farms, groups of farms, or a village, or groups of records representing projects, areas, regions, etc.

Generally speaking, early seasons are superior to late seasons. Early seasons last longer and produce more water, usually also more water per day on average. The initial analysis determines an onset date for each season of record - defined in terms of rainfall adequacy to start a crop within acceptable limits of risk - and then determines rainfall duration thereafter, quantifying amounts and daily intensities throughout the season, divided as desired into shorter time periods.

Graphical analysis follows, illustrating how season duration, water amount, average daily intensity, amounts and intensities in specified growth stages, etc, have historically related to onset dates. The graphs show quantitatively how probabilities of different rainfall characteristics worsen with later onset.

The critical date separating early seasons from late seasons is selected arbitrarily by visual inspection of the graphs - usually the graph of season rainfall duration versus date of onset which clarifies when one should shift from a longer growing period variety to one with earlier maturity. The graph of season water amount and/or average water amount per day, is then used to determine if there should also be a change in the acreage apportionments of crops being grown, or even a change in the types of crops.

Reanalysis of the rainfall record, based on the above selected crops and their growing periods then allows determination of rainfall probabilities for each stage of growth. For example, early onset at some locations is often followed by relatively long dry periods before the rains gain strength again. Were seed planted and germinated by onset rains, the seedlings could die and require replanting. This risk is easily mitigated or even eliminated by redefining onset to require sufficient buildup of soil water (prior to seeding) to assure both germination and seedling survival. Similarly, should rain historically show too much weakness in the pollination period of growth, imposition of an "earliest acceptable planting date" (perhaps a week or so after onset) may shift that growth stage to a more secure rainfall period.

Having decided on crops, varieties, and acceptable planting criteria, the next step is to decide on slopes of plant rows to balance desired rainfall runoff (if any) with capture and infiltration of rain where it falls. For example, in Sri Lanka early onset rainfall intensities seldom threaten waterlogging of the root zone, so call for essentially flat rows to capture all of the rain. However, late seasons, though short, are unusually intense, often requiring surface drainage of the excess to prevent waterlogging. This fact has led to the ancient and ongoing practice of maintaining tanks (reservoirs) in each village to collect runoff and, following cessation of the rains, irrigating with it to extend the growing period for crops. Thus, seedbed preparation, particularly slopes, may differ in late seasons from that in early seasons.

The next decision concerns plant numbers and row spacings which, respectively, affect seasonal crop water requirements and time sequences of soil water extraction. Published water requirements and estimation methods, are predicated on relatively high plant populations - enough to reach a "Leaf Area Index" (LAI) of 3.0 or greater. But in many areas of low or uncertain rainfall, LAI seldom reaches 3.0, and may be only 1.0 or even less. When LAI is 1.0, the crop water requirement is about 70% or so of published figures. Reducing plant numbers in drier seasons - by lower seed rates and/or thinning of seedlings - may be crucial to the health of each plant left in the field, and its ability to produce a near-normal component of yield. Late season onset dates may dictate lower seeding rates. Then seedling period rains, say rains in the first 30 days after germination, become the best indicator as to whether to thin the crop or not.

Another key factor is fertilizer, especially nitrogen (N), which is costly, yet essential to markedly increase yields in good rainfall years. N should be used to attain target yields, based on expected rainfall. Happily, N applications may be split, with a portion applied at seeding time and a second portion at thinning time, but only if justified by good rains in the seedling period. If seedling period rains are weak, the second N application may be reduced or eliminated, and plant numbers reduced by thinning. To carry out the above described rainfall analyses and flexible cropping system design procedures for early versus late rainfall seasons, WHARF has gathered daily rainfall data representative of farming areas worldwide. Additionally, WHARF has created three highly specialized computer programs:

(1) "CONVERT" transforms ASCII files of daily rainfall and other meteorological parameters from collaborating scientists' data banks to WHARF format;

(2) "WHARFDAT" checks data quality, permits hand entry of data and/or error correction as required, adjusts data for desired units, stores, retrieves and prints them out in several forms useful for understanding of weather patterns. WHARFDAT also converts WHARF data files to ASCII format for export to collaborating scientists who so desire.

(3) "WHARF" analyzes daily rainfall records from the past as they would have impacted on crop production - determining onset/germination dates for each past season, and quantifying extractable water stored in the soil at germination - whether dryplanting or seeding only after attainment of a user defined "onset" of the rains - then quantifying rainfall amounts and intensities through any specified sequence of growth stages until maturity. If days to maturity are unspecified, the WHARF program will determine the general suitability of the rainfall regime for cropping, quantifying viable lengths of growing seasons for varietal selection, and season water supplies (germ soil water + all subsequent rainfall) which, when compared to known water requirements of alternative crops, facilitates selection of crop types to receive closer scrutiny. The unique aspect of the WHARF program is a highly sophisticated and accurate bare soil (or stubble-mulched) water balance algorithm which can track rains through fallow periods exceeding two years, quantifying amounts of water stored in the (future) root zone versus losses to evaporation.

PRACTICING RESPONSE FARMING AT THE FIELD LEVEL - Rainfall analyses will have revealed the critical date separating "early" from "late" seasons, and guided us in designing an early season cropping system (Plan A) with suitable modifications for late seasons (Plan B). Full details will have been communicated to farmers, who prepare in advance to follow either plan as soon as the current season date of onset is revealed. This may be done at a central point for all farmers in a localized area by WHARF program analysis of realtime rain events in the budding new season, using measurements from a representative met station nearby. After germination, seedling stage rains may be tracked to determine whether or not an additional application of N fertilizer is called for, and whether or not to reduce plant numbers by thinning.

BIOFUELS, CLIMATE CHANGE AND GM CROPS – WHO IS REALLY BENEFITING?

Panos
(Panos London promotes the participation of poor and marginalised people in national and international development debates through media and communication projects)
http://www.panos.org.uk/

Governments, oil companies and agribusinesses all support biofuels as a way to combat climate change. Genetic engineering plays an increasing role in biofuel production. Can replacing fossil fuels with biofuels reduce carbon emissions? Biofuels are renewable fuels produced from crops or biomass, including crops grown specifically for converting into fuel. Political leaders and businesses increasingly suggest biofuels as an alternative to declining fossil fuel reserves. One attraction is that they can reduce a country's dependence on imported fuel supplies, an increasingly important political issue.

Several countries invest in biofuels:

- Brazil leads the world in domestic biofuel production, mostly from sugar cane.
- Small-scale production helps small communities to raise an income and meet their fuel needs, for example in Peru.
- The European Union target for biofuels in the transport sector is 5.7 percent by 2010. In March 2007, the European Council agreed a binding minimum level for biofuels of 10 percent of vehicle fuel by 2020.
- The USA has recently built more than 50 ethanol refineries to meet its target of producing 5 billion gallons of biofuel each year by 2012.

Ambitious targets in rich countries have placed demands on developing countries to provide crops for biofuel, especially maize. It is not clear whether developing countries can benefit from large-scale biofuel production because growing crops for biofuel can take up water and land currently used for domestic food production. Reduced exports of crops from rich countries can also hit poor people; in 2007, there were demonstrations in Mexico about the rising price of maize from biofuel demand. Some governments support biofuels to meet targets to reduce carbon emissions. However, biofuels have limitations as a source of 'clean' energy. Many have low or negative carbon savings, because growing crops and the process of converting them into fuel is energy-intensive, often relying on fossil fuels. Clearing land for biofuel crops also affects natural ecosystems, particularly tropical rainforests. In the Amazon, clearing forest for biofuel crops releases more carbon into the atmosphere than the biofuels save.

Research into biofuels based on cellulose from trees or crop wastes uses genetically modified (GM) bacteria and enzymes to break down plant waste and convert it to biofuels. Other GM research seeks biofuel crops which grow faster. High-yield GM biofuels crops also require large land areas, putting pressure on natural vegetation or displacing food crops. Shared concerns, as with food crops, include the impact of GM organisms on human health and the environment, such as the risk of genetic pollution. Biofuels are attracting increasing attention and investment as an alternative to fossil- based fuels. Before trying to meet global fuel demands and increase trade in developing countries, governments in each country must answer some important questions:

- Will the biofuel industry in developing countries support local energy needs, or just meet the demands of richer nations?
- Will biofuel crops displace domestic food production?
- Are there laws and controls in place to track any GM organisms used to produce biofuels?
- Has there been any public discussion about GM crops, and which issues do people consider most important?
- What limits are there to ensure that expanding the area of cultivated land does not damage natural ecosystems?

ENVIRONMENTAL ASPECTS OF BIOFUELS

Biofuels production, trade and sustainable development: emerging issues

Annie Dufey
Environmental Economics Programme/Sustainable Markets Group

Energy balance

Energy balance refers to the point at which the energy required to produce one unit of biofuel is greater than the energy than comes out, and production is therefore not viable. There is debate about whether biofuels have a better negative energy balance than conventional fuels. This debate started in the early 1970s and criticisms are mostly based on experiences of corn-based ethanol. However, as the following analysis suggests, biofuels do have a better energy balance but there are important differences depending on the different types of biofuel.

Estimating the net impacts of biofuels' energy balance is a very complex issue. Energy balances need to consider the entire fuel cycle, from feedstock production to final consumption – the so-called 'well-to-wheels' approach. Assessments should also include energy paybacks associated with the co-products - the so-called 'co-products credits'. Energy balances vary depending on the type of feedstock used and methods of cultivation as well as the conversion technology. There are also differences depending on the methodology used to calculate the energy balance (e.g. assumptions regarding co-products energy balances).

Brazilian sugarcane-based bioethanol, for instance, is deemed to be one of the most energy efficient forms of bioethanol, with energy balance estimates varying between 3.7 and 10.2 units, with an average of 8.3 units.139 Brazil's natural conditions mean that soil productivity is very high, requiring almost no additional inputs, and sugarcane crops are rain fed. In addition, nearly all conversion plants' processing energy is provided by 'bagasse' (the remains of the crushed cane after the sugar has been extracted), which means energy needs from fossil fuel are zero. The surplus bagasse is even used for electricity co-generation.

Estimates for corn-based bioethanol in the US, on the other hand, show that it generates about two units of energy for each unit required in production. The lower energy balance comes about because US corn cultivation requires higher quantities of petrochemical fertilisers and toxic pesticides and the corn processing for bioethanol requires additional fossil fuel. Estimates for wheat-based bioethanol in the EU range between 0.81 and 1.03 units whilst figures for bioethanol from sugarbeet vary between 0.56 and 0.65 units.

Most studies for biodiesel focus on biodiesel from rape, and suggest an energy balance of between 0.33 and 0.82 units. But Macedo (2004) compares the energy balance of biodiesel from palm oil, castor oil, and soya oil in Brazil. He suggests the best energy balance is for palm oil (5.63 units) while the worst is for soya oil (1.43 units) (see Figure 12). According to IEA 2004: the amount of energy and GHG emissions that co-products of biofuel production processes, such as animal feed, oil, glycerine and co-generated electricity, help displace by reducing the production of competing items.

*Other lesser-known energy crops such as jatropha and some new technologies based on perennial crops such as lignocellulosic are proving to have the best energy balances. Jatropha, for instance, is alleged to have the highest energy balance of any biofuel. Unlike corn or sugarcane, jatropha is a perennial, yielding oil seed for decades after planting. It can grow without irrigation in arid conditions where corn and sugarcane could never thri*ve. Lignocellulosic ethanol is based on grasses such as woody crops, which can be grown on marginal land, require little

fertiliser or water and have higher energy contents. According to the US Department of Energy, for every unit of energy available at the fuel pump, only 0.2 units of fossil energy are used to produce cellulosic bioethanol, 1.23 units of fossil energy is used to produce gasoline and 0.74 of fossil energy is used to produce corn-based bioethanol.

Differences in energy efficiency balances imply that there are better opportunities for crops such as sugarcane, sweet sorghum, palm oil and jatropha to become global energy sources. Crops with lower yields require so much land that they would not be able to compete economically with those with higher yields. Soya beans, for instance, despite being the preferred source of biodiesel in Brazil, are expected to be replaced by more efficient vegetable oils such as palm oil and castor oil as the biodiesel industry develops. However, the existence of policy incentives could mean that the biofuels market develops in favour of those crops that are not necessarily the most energy-efficient. This is important as the highest levels of domestic agricultural support are in industrialised countries while the crops with the best energy potential are grown in tropical developing countries.

Greenhouse gas (GHG) emissions

One of the greatest advantages associated with biofuels and one of the main driving forces behind worldwide biofuel uptake are their alleged reduced GHG emissions, and hence their potential to help minimise climate change. The basic argument is that because growing feedstocks absorb CO2, the release of CO2 emitted during biofuel combustion does not contribute to new carbon emissions since the emissions are already part of the fixed carbon cycle.

However, there is considerable variation in GHG savings – ranging from negative to more than 100%. Estimates vary according to the type of feedstock, cultivation methods, conversion technologies, energy efficiency assumptions and disparities regarding reductions associated with co-products. Bioethanol shows the widest variations. A recent article published in the journal *Science*, which evaluated six studies on GHG reduction of corn-based bioethanol found a variation from a 33 per cent decrease to a 20 per cent increase, averaging a 13 per cent reduction in GHG emissions compared to petrol.

The study also argued that the reduction could actually be improved, as figures calculated did not reflect incentives available for GHG emission control. Estimates for wheat-based bioethanol point to reductions ranging from 19 to 47 per cent, while for sugar beet-based bioethanol estimates vary between a 35 to 53 per cent decrease. One estimate for sugarcane-based bioethanol in Brazil shows a 92 per cent reduction compared to standard fuel. Estimates for newer technologies such as lignocellulosic ethanol are only available from engineering studies, as very few large-scale facilities exist. They typically suggest a 70 – 90 per cent reduction but can achieve a 100 per cent reduction compared to conventional gasoline.

The variation in levels of GHG emissions for different types and sources of biofuels make it difficult to predict the achievement of GHG reduction targets for policy makers in countries that rely on various sources of biofuels. This highlights the need to identify biofuels with lower GHG emissions and create incentives for their production. There are currently some initiatives being developed to address this issue through biofuel certification according to carbon intensity. At the same time it is important to bear in mind that biofuels are not deemed to provide a final solution to global warming but they form an important component of an integrated approach to tackling the issue.

NEWS

Urgent measures required to reduce impact of high food prices on the poor

UN agency chiefs highlight role of agro-industries

New Delhi, 9 April 2008 – Urgent measures are needed to ensure that short-term adverse effects of higher food prices do not impact even more alarmingly on the very poor, FAO Director-General Jacques Diouf said today.

Addressing the first Global Agro-Industries Forum in New Delhi, along with the heads of UNIDO and IFAD, Dr Diouf highlighted the important role that agro-industry had to play in overcoming these problems.

“World food prices have risen 45 percent in the last nine months and there are serious shortages of rice, wheat and maize,” Dr Diouf said.

A combination of factors, including reduced production due to climate change, historically low levels of stocks, higher consumption of meat and dairy products in emerging economies, increased demand for biofuels production and the higher cost of energy and transport have led to surges in food prices.

UNIDO’s Director-General, Kandeh K. Yumkella, said: “Climate change will impose great stresses on the world’s ability to feed ever growing populations. This challenge brings new threats to arable land areas, livestock rearing and fisheries through droughts, water shortages and pollution of land, air and sea. It is, after all, agricultural and livestock production that provide the raw materials that are basic to human existence – especially food.”

The President of IFAD, Lennart Båge, told the conference that in recent years, a number of developing countries have become net importers of food. In countries from Bangladesh to Zambia, nearly 40 per cent of the population was undernourished. “The explosive and rapid rise of food prices is worsening their situation,” Båge said.

“With greater investment in agriculture and rural development, the world’s 400 million smallholders could mobilize their under-utilized potential, not only to improve their own nutrition and incomes but to enhance national food security and overall economic growth,” the IFAD President said.

Potential of agro-industry

Dr Diouf said: “It is essential to increase agricultural investment in water control and infrastructure and to facilitate small farmer access to inputs, so they can raise their productivity.” He stressed the importance of effective marketing and processing systems for agricultural products.

“Agro-industry helps preserve foodstuffs, add value and reduce post-harvest losses; it enables products to travel longer distances, including to the rapidly expanding cities,” he noted. “For its part, agro-industry generates demand for agricultural products and holds vast potential for off-farm rural employment. It also adds significant value to farm production, whether for domestic or export markets.”

The Global Agro-Industries Forum, being held from April 8-11, has attracted over 500 participants from 120 countries. Both government and private sectors are represented and there are also participants from NGOs and farmer organizations.

Benefit sharing

The Agency Heads warned that the benefits of agro-industrial development might not be universally shared, as small agricultural enterprises are facing difficulties in some countries. Customs tariffs, non-tariff barriers, standards and certification requirements, and export volumes demanded constitute major impediments for many small exporters.

Urbanization, rising incomes and women joining the labour market in many countries have boosted demand for convenience food. Worldwide, processed food and beverages now account for 80 percent of total food and drink sales, which rose 57 percent between 2001 and 2007. Partly in response to this trend, there has been a rapid expansion of supermarkets in many countries, notably in Latin America and Southeast Asia.

FAO, in partnership with the other agencies and NGOs, is working to establish solid links between small farmers and buyers, by grouping and organizing farmers into producer associations and cooperatives.

Dr Yumkella said that for the UN system and its development partners the challenge was to cooperate: to help agro-industrial enterprises to grow and flourish; to provide jobs and create wealth; and, thus to foster sustainable economic and human development.

The New Delhi Forum is jointly organized by FAO, the United Nations Industrial Development Organization (UNIDO) and the International Fund for Agricultural Development (IFAD), in close collaboration with the Government of India.

FAO is also organizing a High-Level Conference on "World Food Security: the Challenges of Climate Change and Bioenergy" at its headquarters in Rome from 3 to 5 June 2008, thus offering a forum for Heads of State and Government to discuss the pressing challenges facing global food security and to adopt required actions to deal with the situation.

Indigenous peoples play key role in coping with climate change – IUCN

Gland, Switzerland, March 17, 2008 (IUCN) – Indigenous peoples around the world will bear the brunt of climate change – but they are also armed with the traditional knowledge to survive its effects.

That's the message from the first comprehensive analysis of the effects of climate change on indigenous peoples, which is released today by IUCN (International Union for Conservation of Nature).

"Indigenous peoples are literally living on the edge – highly dependent on natural ecosystems, they usually occupy marginal lands, are under pressure socially and many lack proper political representation to improve their situation," says Gonzalo Oviedo, IUCN Senior Advisor on Social Policy, and co-author of the report. "As a result they are especially vulnerable to climate change.

"But they're not just victims," says Julia Marton-Lefèvre, IUCN Director General. "Because of their long dependence on nature they've developed strategies to cope with climate change and extreme natural events which still have as much relevance today as they did hundreds of years ago."

The report identifies such strategies, including the traditional Quezungal farming methods in Central America which involves planting crops under trees so the roots anchor the soil and reduce the loss of crops when hurricanes strike.

The report maps out the areas of the world which will be most vulnerable to climate change in the future and how this will impact on indigenous peoples. It calls on policy makers to take indigenous people's experiences into account when making climate change policy.

Climate change will be one of the major issues discussed at IUCN's World Conservation Congress in Barcelona this October.

FAO unveils new bioenergy assessment tool

Weighs impact on food security

8 February 2008, Rome – A decision-support tool developed by FAO will help ensure that countries can enter the rapidly growing field of bioenergy industry to produce benefits for the poor without jeopardizing their food security.

The tool, an "analytical framework" designed by a team of economists from FAO, Utrecht University's Copernicus Institute and Darmstadt's Oeko-Institut, was unveiled at a two-day experts' meeting of FAO's Bioenergy and Food Security (BEFS) project. The three-year project, funded by Germany, is aimed at making sure that bioenergy does not impair global food security.

The analytical framework allows governments interested in entering the bioenergy sector to calculate the effect of their policy decisions on the food security of their populations. Bioenergy can affect food prices and rural incomes and thus has important implications – both positive and negative -- for food security.
Positive outcomes

Applying the analytical framework will enable national policy makers to minimize negative consequences while maximizing positive outcomes.

A prerequisite for running the framework is the establishment of a bioenergy development scenario, a process in which FAO helps government clearly define their bioenergy policy options and the various possible strategies to achieve those options.

The analytical framework then makes it possible, through five steps, to assess: technical biomass potential; biomass production costs; the economic bioenergy potential; macro-economic consequences; national and household-level impact and consequences on food security.

Vulnerable households

Analysis of the results will make it possible to determine actual bioenergy potential and which households are most vulnerable and thus at risk of food insecurity.

Existing mathematical modelling tools such as Quickscan, which calculates global bioenergy potential to 2050, and FAO's COSIMO, which models the agricultural sector in a large number of developing countries, will be used.

The framework will be field-tested in three countries – Peru, Thailand and Tanzania – before the analytical framework methodology is made available to the international community at large.

Kyoto II

Alexander Müller, FAO Assistant Director-General for natural resources and the environment, said that FAO would make every effort to ensure that food security issues are on the table when a successor to the present Kyoto Protocol is negotiated. Although climate change could reduce yields from the main crops in sub-Saharan Africa by up to 40 percent in the next 25 years, food

security is not part of the negotiations road map adopted at last December's UN Conference in Bali, Mr Müller noted.

"The challenge will be huge for sub-Saharan Africa," Mr Muller said. According to experts, however, the development of the bioenergy sector in Africa could help mitigate the effects of climate change there.

FAO is organizing a High Level Conference on World Food Security and the Challenges of Climate Change and Bioenergy in Rome from 3 to 5 June.

Rome UN Agencies urge immediate climate action to avert hunger

FAO Director-General announces High-Level Conference

12 December 2007, Bali – Expressing their "deepest concern", the three Rome-based UN Agencies – FAO, the World Food Programme and the International Fund for Agricultural Development – warned today that climate change is a major challenge to world food security and will increase hunger and malnutrition unless immediate action is taken.

FAO Director-General Jacques Diouf, speaking on behalf of the three agencies, told the UN Climate Change Conference here that extreme weather events are already having adverse effects on food security and that changes in the medium term would have further negative impacts.

"If we do not act now, climate change will increase the number of hungry people in the world," he said. "Climate change is a major challenge to world food security." FAO's 2006 State of Food Insecurity Report estimated that 854 million people worldwide suffer from hunger and malnutrition, including 820 million in developing countries.

Climate change to hit the most vulnerable

"Vulnerable people and food systems will be particularly affected," Dr Diouf said. "People who are already vulnerable and food insecure are likely to become even more so."

Three out of four of the world's one billion poorest people live in the rural areas of developing countries and face immediate risks from increased crop failures and loss of livestock. More than 1.5 billion forest-dependent people, among the poorest in the world, are highly vulnerable too, as are 200 million people dependent on fisheries.

"It is paramount that we address food security concerns when discussing the challenges of climate change," Dr Diouf declared, announcing that in June next year FAO will organize a high-level conference to address world food security and the challenges of climate change and bioenergy.

Strengthened resilience

Dr Diouf said immediate action was vital to increase the resilience of rural people to climate change and help them adapt to new conditions. While efforts must be redoubled to ensure that a growing world population had access to sufficient, safe and nutritious food, specific action to be deployed included: early warning systems; adaptation strategies; disaster risk- reduction activities; and hunger safety-net initiatives.

Sustainable forest management also offered opportunities for immediate mitigation and adaptation, Dr Diouf said. Deforestation was responsible for some 17 percent of global Greenhouse Gas (GHG) emissions so that improved forest management could provide

"comprehensive, rapid and effective action" while at the same time benefiting the rural poor and capturing environmental co-benefits.

Payments for environmental services and for carbon conservation and sequestration could be made to farmers living in fragile ecosystems, Dr Diouf suggested.

Increased investment

Integrated strategies and collaborative approaches are required to overcome the multiple threats of climate change, Dr Diouf said. "Effective implementation will require increased investment in agricultural development and natural resources management at all levels." But trade-offs between the agriculture and energy sectors had to be carefully balanced.

FAO, IFAD and WFP pledged to use their knowledge, expertise, global field presence and investment programmes "to give our continued support to countries and to collaborate with our Member Countries and other partners, within and outside the United Nations, to ensure that the impacts of climate change do not exacerbate hunger and poverty", Dr Diouf concluded.

High Level Conference

The High-Level Conference on World Food Security and the Challenges of Climate Change and Bioenergy will be held in Rome from 3-5 June 2008. The focus will be on how agriculture can continue to produce adequate quantities of food for the world's growing population, and particularly the poor and vulnerable, in changing climatic conditions. The Conference will address the specific challenges from climate and bioenergy for the food, agriculture, forestry and fisheries sectors.

Climate change causing species disappearance in mountain areas

Fresh water, animal and plant species threatened

11 December 2007, Rome – Higher temperatures are affecting mountain ecosystems and their populations, as melting glaciers increase short term water availability but also raise the likelihood of flooding, species migration and long term water shortage, FAO warned today during the commemoration of the International Day of Mountains.

"As glaciers disappear and snowlines move upwards, river flows are likely to change and lack of water may lead to conflict and affect hydropower generation, forestry and agricultural-based livelihoods," said Alexander Müller, FAO Assistant Director-General for Natural Resources.

The services that mountain ecosystems provide often extend well beyond their geographic areas and include water balance, climate regulation, and maintenance of different species of plants and animals.

The main reason for climate change is increasing concentrations of greenhouse gas emissions. Man-made global greenhouse gas emissions have grown markedly in the past 30 years rising by 70 percent between 1970 and 2004, according to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Agriculture, forestry and fisheries are affected by global warming and mountain areas are highly susceptible.

In Bhutan, for example, glaciers are now retreating 20-30 metres a year with devastating effects downstream as a result of flooding, leading to loss of life, crops and pasture lands. The ice cap once known as the "sleeping lion" in the Andes of Peru has completely disappeared, resulting in intermittent or dry drainage channels causing herders to move grazing herds and increased concern for the future of irrigation, electricity generation and mining.

Higher temperatures as a result of climate change may also affect the health of both livestock and people, as malaria is likely to continue moving to higher altitudes as is already the case in East Africa and the Andes. For wild animals, a warmer climate may mean extinction as their habitats disappear.

Role of FAO

To date, climate-induced changes have led to adaptation through, for example, technological measures such as preventing the bursting of glacial lakes in the Himalayas or safeguards against slope instability due to permafrost decay in northern Europe. Mountain ski resorts in Europe and North America have started diversifying their services to compensate for the loss of winter tourism caused by the lack of snow. FAO is working with governments on watershed management and use planning and zoning for both mountains and lowlands as floods, landslides and avalanches are likely to become more severe and affect areas until recently considered safe.

In Bhutan, a National Climate Change Committee has been set up which will identify safe and unsafe zones for settlement in potential flood-affected areas. People in rural areas, for example, have been given radios as a basic early warning tool.
Measuring the effects on mountain areas

There is a growing need for more data and understanding at the regional and local levels of the impact of climate change and variability on mountain communities as well as on options for adaptation.

“FAO has a vital role to play in addressing the serious challenges confronting the vast number of mountain communities in developing countries who are often the poorest and most food insecure,” said Alemneh Dejene, Senior Officer, Environmental Assessment and Management Unit.

This and other issues concerning climate change will be considered by a high-level meeting on World Food Security and the Challenges of Climate Change and Bioenergy to be held at FAO from 3 to 5 June 2008.

Climate change: focussing on how the vulnerable can cope

FAO pilots emerging strategies to alleviate weather-related consequences

7 December 2007, Rome - With higher temperatures, unpredictable rainfall, and a potential sea level rise, entailing more frequent or more intense disasters, no part of the world will be safe from the impacts of the changing climate. Today, many such disasters are already being witnessed with a heavy toll in terms of social, economic, and environmental consequences.

But in what way would the massive shifts in the climate system feel and reflect on a human scale? What do big climatic changes mean for the small farmers in the field, who directly rely on natural resources for their daily food, livelihood and well-being? How would such vulnerable individuals be differently affected by a changing climate, and are there ways to improve their ability to cope?

These are questions FAO is gearing up to confront and strive to resolve, by examining and integrating the gender and equity aspects of climate change, and exploring how men and women farmers in the developing countries are differently affected by, and unequally able to live with the recurrent effects of climate variability and change, almost every day. FAO experts aim to advise governments on how to incorporate gender and equity concerns into their plans for adapting to the worsening impact of climate variability and change. Within the shifting strategic priorities for the future it is FAO’s responsibility today, more than ever, to put gender concerns right into the mainstream of all its work.

Not alike in vulnerability and ability

Underlying socio-economic conditions will in part shape how natural-resource dependent communities and individuals experience climate change. The ability to earn an income or obtain credit; access to and control over resources like land, water or seeds; and the education level are some of the socio-economic factors that determine a person's ability to cope with the impacts of climate variability and change on food security and livelihoods.

But men and women often have different socio-economic conditions, because gender-based roles and responsibilities affect their options for earning a living, their access and rights to land and credit, their education levels, and other rights and duties. This means that men and women are not alike in terms of their vulnerability and their ability to prepare for or recover from shocks to their livelihoods. Climate change – a major shock – would impact men and women in different ways as they may not have access to the necessary tools and support to ensure that their livelihoods are sustainable.

Strategies to prepare for escalating impacts of climate variability and change that do not take into account the cultural and socio-economic differences among men and women, will simply fall short of addressing the needs, or incorporating the knowledge, of all those who are likely to be damaged.

FAO-funded research model

Research considering the gender aspects of climate change is only just emerging. However, disaster management research shows that women are more vulnerable than men to weather-related disasters. Also, in the wake of disasters, it has been found that women and men farmers possess distinct knowledge which contributes to recovery, and when outside assistance explicitly targets women as well as men, it tends to be more successful.

In order to gather more concrete information on the gender component of climate change, FAO Senior Officer Yianna Lambrou recently travelled to Andhra Pradesh, India, to speak with farmers. She initiated an FAO-funded research project with local NGO's and research centres aiming to examine the gender dimension of farmers' experiences with climate variability. Ultimately the objective is to develop a model for gathering knowledge and documenting what farmers know about coping in the short term with climate variability and in the long term with change, in order to establish the types of support they will need for withstanding impacts on their livelihoods in the long run.

Explaining some initial findings from her trip to India, Ms Lambrou, said: "We recorded farmers' responses to drought, and observed a gender dimension, with men migrating and women taking on new responsibilities at home and in agricultural practices". She added: "We have also started to study outside interventions and how they match communities' needs, found examples of women attending government training and heard reports of training bolstering a community's food security".

The role women and their communities in the developing counties can play, has to be acknowledged and considered in formulating an international strategy to enable the most vulnerable in the field to deal best with the effects of climate variability and change, according to FAO, if we hope to alleviate its worst consequences. "Without addressing gender inequality in climate change adaptation policy, we simply risk making little progress in achieving the Millennium Development Goals and, thereby risk making the world's most vulnerable people even more vulnerable", said Marcela Villarreal, Director of FAO's Gender, Equity and Rural Employment Division.

Next Steps

Addressing the gender component of climate change is gaining support from researchers and policymakers, as indicated by the first-time consideration of gender aspects in a portion of the 2007 assessment of climate change research, by the authoritative Intergovernmental Panel on Climate Change (IPCC).

An eight-member official FAO delegation led by the Director-General, Jacques Diouf, is currently attending the United Nations Climate Change Conference in Bali (3-15 December 2007).

Living with climate change

Adaptation strategies needed to build resilience

10 September 2007, Rome - Climate change is emerging as one of the main challenges humankind will have to face for many years to come. It could become a major threat to world food security, as it has a strong impact on food production, access and distribution.

Abnormal changes in air temperature and rainfall and the increasing frequency and intensity of drought and floods have long-term implications for the viability and productivity of world agro-ecosystems.

This was the main message delivered today by Alexander Müller, FAO Assistant Director General, to over 140 world experts convened in Rome for a workshop on “Adaptation Planning and Strategies."(*) While continuing to deal with the causes of climate change -- by reducing emissions and increasing greenhouse gas sinks -- it is crucial, Müller said, to also take immediate action to cope with its effects. Ways must be found to build up peoples’ resilience as well as that of food production systems, he added.

Developing countries at risk most

Agriculture is the sector most affected by changes in climate patterns and will be increasingly vulnerable in the future. Especially at risk are developing countries, which are highly dependent on agriculture and have fewer resources and options to combat damage from climate change.

In the short term, as the global average temperature rises 1-3º C, industrialized countries may well gain in food production potential. However, in lower latitudes -- especially in subsistence sectors, marginal, semi-arid and sub-humid regions, where rain fed agriculture is the norm -- even with a minimal rise in global temperature crop potential will most probably decline.

Agriculture both culprit and victim

Agriculture is both culprit and victim when it comes to climate change.

It is estimated that the livestock sector alone accounts for 18 percent of global greenhouse gas emissions, while deforestation is responsible for 18 percent of carbon dioxide emissions.

According to FAO, introducing improved livestock management and crop practices, coupled with adaptive management of forests, could have a very significant impact. Adopting land use practices such as conservation agriculture would also help to maintain significant amounts of carbon in the soil.

Rice production is another major source of greenhouse gas emissions. It is perhaps the main source of anthropogenic methane, with some 50 to 100 million metric tons per year emitted from the world's 130 million hectares of rice paddies.

At the same time adverse and extreme weather conditions can jeopardise rice crop production, which feeds more than half the world's population. Of major benefit would be introducing different and improved rice varieties with greater salinity tolerance. These were successfully used by FAO to expedite the recovery of production in areas damaged by the 2004 Asian tsunami.

More hardy varieties, yielding over four tons per hectare, have been developed and tested successfully in Bangladesh, a country repeatedly affected by flooding.

The rapid transition toward greater use of biofuels could also help to reduce greenhouse gas emissions, so long as food security and environmental considerations are taken into account.

The role of FAO

Climate change is a global phenomenon with local or regional features which needs to be understood and anticipated.

"FAO is already actively assisting its Members, particularly developing countries, to enhance their capacity to confront the negative impacts of climate change on agriculture, forests and fisheries", said Müller. This means helping people to adapt their agricultural systems to changed conditions and specific stresses. It involves providing creative solutions and alternative approaches, such as introducing crop varieties that can tolerate heat and water stress.

Müller went on to say that forecasting extreme events and trends by collecting data and developing tools to produce on-hand information for adapting countries' agriculture is another area that needs greater attention.

(*) The workshop "Adaptation Planning and Strategies" is organized by the Secretariat of the United Nations Framework Convention on Climate Change, under the Nairobi work programme on impacts, vulnerability and adaptation to climate change. It is part of a series of meetings to assess strategies to cope with the effects of climate change.

Gates Foundation boost for climate-hardy rice

4 February 2008
Source: SciDev.Net

BEIJING – The Bill and Melinda Gates Foundation has announced a grant to aid the production of stress-tolerant rice varieties.

The US$19.9 million grant for the Philippines-based International Rice Research Institute (IRRI) will be used to develop suitable rice varieties to help poor farmers in Africa and Asia mitigate the effects of climate change.

Announced last month (25 January), the three-year funding is part of a US$306 million package of agricultural development grants announced by the foundation at the World Economic Forum in Switzerland.

The money will be used to develop and distribute rice varieties that can withstand drought, floods and salty water to 400,000 farmers in Asia and Africa who rely on rain fed agriculture so are vulnerable to such effects.

The project ultimately aims to reach 18 million households and help farmers achieve a 50 per cent yield increase in the next 10 years.

Duncan Macintosh, IRRI spokesperson, told SciDev.Net that the harsh conditions caused by climate change threaten global rice production — rice prices in Asia have more than doubled in the past 2–3 years.

The rice-science community, in particular IRRI, have recently taken steps towards developing stress-tolerant crop varieties by precision breeding — the movement of specific genes from one variety to another. However, research and application in this field face difficulties.

"There are two main challenges. The first is adapting [varieties] to many local environments and conditions. It will take many varieties to cover all the conditions. The second challenge is the dissemination to farmers," says Macintosh.

According to Macintosh, IRRI will disseminate the new rice varieties through its traditional partners, the ministries of agriculture in each country, as well as new partners such as nongovernmental organisations and their networks, and private sector partners.

Wang Feng, a leading scientist at the Fujian Academy of Agricultural Sciences, says the project will greatly help poor farmers in Africa and Asia.

"But providing rice varieties alone is far from enough. Improvements in irrigation conditions and mechanisation, and providing technology training courses for farmers to improve rice planting in local areas are indispensable," Wang told SciDev.Net.

PUBLICATIONS

Potential Impacts of Sea-Level Rise on Populations and Agriculture

http://www.fao.org/nr/climpag/pub/EIre0045_en.asp

SEVERAL FACTS emerge from the literature, analyses and the data presented in the present paper. First, accelerated sea-level rise seems to be one of the more "certain" consequences of global climate change with a "worst scenario" increase of 95 cm by 2100, while the population of the world will stabilize around 2050 with urbanization continuing to increase. Current population densities are generally highest - and the GDP lowest - in the more insular countries of the world.

Large relative local differences will be observed in sea-level rise, resulting in large local differences in impacts. In general, it is likely that the relative importance of coastal disasters will decrease, even if their number and the associated economic losses are likely to increase due to general economic development.
Direct effects on the most vulnerable coastal areas, for instance deltas, are difficult to assess, in particular because the dynamic of deltas is determined by climatic conditions in the whole catchment basin and because coastal climates do not follow general patterns. Potentially, coastal and delta agriculture and populations will adapt to changing conditions, but impact of local disasters could increase. In general, the relative cost of protection (as a percentage of GNP) will be much higher in small island states than in other coastal areas, where the capacity to invest in protective measures is limited.

Current trends indicate a possibility that "medium" vulnerability will increase, but extremes could decrease in relative frequency at a global scale, based on current observations and population trends. In particular, the trend towards greater urbanization constitutes a positive factor in the present context, as cities provide a rather safe environment. Many variables examined display a positive skew: where the extremes of one or more of the variables are at play at the same time, risks will be very high.

It is clear that, given the gradual nature of the foreseen changes, populations and agriculture will gradually adapt and move. The cost of protection is found to be relatively high in many small islands (5% of GNP, and above); protective measures may be possible only where their cost remains low compared with GNP growth.

Policy measures will have to include construction standards and other non-structural preventive measures (emergency plans, insurance) in addition to protection. Some countries should take action now to ensure that their agricultural production is not concentrated in areas which are likely to become more vulnerable under sea-level rise conditions.

It is clear that efforts should be made to identify possible run-away situations, and they should be kept under constant observations.

Disaster Risk Management Systems Analysis; A guide book

Stephan Baas
Selvaraju Ramasamy
Jenny Dey DePryck
Federica Battista
http://www.fao.org/nr/clim/abst/clim_080302_en.htm

This Guide provides a set of tools to assess existing structures and capacities of national, district and local institutions with responsibilities for Disaster Risk Management (DRM) in order to

improve the effectiveness of DRM systems and the integration of DRM concerns into development planning, with particular reference to disaster-prone areas and vulnerable sectors and population groups. The strategic use of the Guide is expected to enhance understanding of the strengths, weaknesses, opportunities and threats facing existing DRM institutional structures and their implications for on-going institutional change processes. It will also highlight the complex institutional linkages among various actors and sectors at different levels. Finally, it will help identify gaps within the existing DRM institutions and/or systems including sectoral line agencies that are often responsible for implementing the technical aspects of DRM (e.g. agriculture, water and health sectors).

The assessment and analysis process outlined in the Guide is thus a first step towards strengthening existing DRM systems. The major areas of application are:

- Strengthening institutional and technical capacities for DRM at national and/or decentralized levels;
- Integrating key aspects of DRM in emergency rehabilitation programmes;
- Designing and promoting Community-Based Disaster Risk Management (CBDRM);
- Operationalizing the paradigm shift from reactive emergency relief to pro-active DRM; and
- Mainstreaming DRM into development and sectoral planning (e.g. agriculture).

The Guide focuses on risks associated with natural hazards of hydro-meteorological (floods, tropical storms, droughts) and geological (earthquake, tsunami, volcanic activity) origin. Users interested in the management of other types of hazard risk are encouraged to adapt the general concepts, tools and methods to their own situations.

Climate variability and change: Adaptation to drought in Bangladesh
A resource book and training guide

http://www.fao.org/nr/clim/abst/clim_070901_en.htm

Selvaraju Ramamasy, Asian Disaster Preparedness Center (ADPC)

Stephan Baas, FAO Natural Resources Management and Environment Department

DP9/1-BGD/01/004/01/99 "Improved Adaptive Capacity to Climate Change for Sustainable Livelihoods in the Agriculture Sector"

In Bangladesh, where agriculture is the largest sector of the economy, agricultural production is under pressure from increasing demands for food. A large percentage of the population is already vulnerable to a range of natural hazards with increasing climate variability and climate change expected to aggravate the situation further by causing more frequent and intense droughts and increasing temperatures. General Circulation Model data project an average temperature increase in Bangladesh of 1.0ºC by 2030 and 1.4ºC by 2050.

Within this context, FAO and the Asian Disaster Preparedness Center (ADPC) are guiding an assessment of livelihood adaptation to climate variability and change in the drought-prone areas of Northwest Bangladesh. The project, implemented under the Comprehensive Disaster Management Programme and in close collaboration with the Department of Agricultural Extension (DAE), is specifically designed to characterize livelihood systems, profile vulnerable groups, assess past and current climate impacts, and increase understanding of local perceptions of climate impacts, coping capacities and existing adaptation strategies.

The initiative has guided development of a good practice menu of adaptation options that is being evaluated and field tested in partnership with local communities. As part of this initiative, a series of capacity-building and training activities on “climate change impacts and adaptation to drought” has been undertaken for national and local-level technical working group members, disaster managers and community representatives. The working group members are drawn from key research and extension organizations in Bangladesh including the DAE, Directorate of Relief and Rehabilitation, Department of Livestock, Department of Fisheries, Bangladesh Rice Research Institute and Bangladesh Agricultural Research Institute.

This resource book has been prepared as a reference and training guide for building the capacity of agricultural extension workers and development professionals to deal with climate change impacts and adaptation, specifically targeting drought-prone areas of Bangladesh. It also presents suggestions for a three-day training course that would be readily adaptable for any areas of Bangladesh affected by climate-related risks. The information presented on climate change adaptation would enable participants to prepare, demonstrate and implement location-specific adaptation practices and, thus, to improve the adaptive capacity of rural livelihoods to climate change in agriculture and allied sectors.

Hazard risk preparedness in agriculture: Good practice examples from south and south-east Asia

Project TCP/RLA/3101 *Assistance to improve Local Agricultural Emergency Preparedness in Caribbean countries highly prone to hurricane related disasters*

http://www.fao.org/nr/clim/abst/clim_070501_en.htm

In the recent past, most Asian countries have greatly improved their capacities to monitor hazards and to warn, evaluate and provide emergency relief to victims of disasters. As a result, the number of lives lost to disasters such as floods, storms and extreme temperature has decreased significantly. However, the vulnerability within the agriculture sector has continuously increased due to its high level of exposure.

It is essential to re-align all disaster management programmes in the agriculture sectors from response to prevention and preparedness. It means, in effect, to shift from the current focus on relief and mitigation activities to all-round early warning, prevention, preparedness, relief, rehabilitation and sustainable recovery activities. It is also required to integrate disaster prevention within the agricultural development processes. There are many examples of farmer-led participatory disaster risk management initiatives at pilot scale in Asia. However, efforts are required at much greater scale to mainstream these pilot scale efforts at the national and regional levels. Although disaster risk reduction is now widely adopted, it still remains a challenge to fully integrate it into agriculture sector development planning.

Developing Institutions and Options for Livelihood Adaptation to Climate Variability and Change in Drought-prone Areas of Bangladesh

R. Selvaraju & A.R. Subbiah, Asian Disaster Preparedness Center

Stephan Baas & Ingmar Juergens, Rural Development Division Research, Extension and Training Division, FAO Sustainable Development Department

DP9/1-BGD/01/004/01/99 “Improved Adaptive Capacity to Climate Change for Sustainable Livelihoods in the Agriculture Sector”

http://www.fao.org/docrep/009/a0820e/a0820e00.htm

The impacts of climate variability and change are global concerns, but in Bangladesh, where large parts of the population are chronically exposed and vulnerable to a range of natural hazards, they are particularly critical**.** In fact, between 1991 and 2000 93 major disasters were recorded, resulting in nearly 200 000 deaths and causing US$5.9 billion in damage with high losses in agriculture. Agriculture is the largest sector of the Bangladesh economy, accounting for some 35 percent of the GDP and 63 percent of the labour force. Agricultural production is already under pressure from increasing demands for food and the parallel problem of depletion land and water resources caused by overuse and contamination. Impacts of climate variability and change cause an additional risk for agriculture.

Within this context, FAO and the Asian Disaster Preparedness Centre are guiding a project to assess livelihood adaptation to climate variability and change in the drought- prone areas of Northwest Bangladesh. The project, implemented under the Comprehensive Disaster Risk Management Programme and in close collaboration with the Ministry of Agriculture Department of Agricultural Extension, specifically looks at: characterization of livelihood systems; profiling of vulnerable groups; assessment of past and current climate impacts; and understanding of local perceptions of climate impacts, local coping capacities and existing adaptation strategies. It also is developing a good practice adaptation option menu, evaluating and field testing locally selected options, and introducing long-lead climate forecasting, capacity building and training of Department of Agricultural Extension staff and community representatives.
This report summarizes the project methodology developed and successfully tested during 2005/06; it discusses interim findings and recommendations coming out of the ongoing pilot learning process.

A Handbook for Trainers on Participatory Local Development

The Panchayati Raj model in India

S.P. Jain & Wim Polman

RAP publication 2003/07, FAO Regional Office for Asia and the Pacific, 2003
http://www.fao.org/docrep/006/ad346e/ad346e00.htm

Awareness that the 'trickle down' effects of economic growth take too long to reach the poor has led to the realization that poverty alleviation programmes cannot be effective unless the poor have a voice in the planning and implementation of schemes meant to help them. This book describes and supports the world's biggest endeavour in grassroots governance taking place in India. Some 238 000 Panchayats (village councils) representing about 600 000 villages have been constituted. Preparing the Panchayat members for their new roles as local decision-makers calls for education and training on a massive scale, for which adapted training methods and tools are needed. Although this handbook is designed for the training needs of all categories of local functionaries associated with the decentralization process in India, it provides guidance on core issues in institutional capacity-building for local development planning, useful for other developing countries within the region.

A SUSTAINABLE BIOFUELS CONSENSUS

Hosted by the Rockefeller Foundation Bellagio Study and Conference Center
Bellagio, Italy, 24-28 March 2008

Declaration

Our vision is of a landscape that provides food, fodder, fiber, and energy, that offers opportunities for rural development; that diversifies energy supply restores ecosystems, protects biodiversity, and sequesters carbon; and that contributes to global peace.

When produced responsibly, increased global biofuels trade, transport use and production can be cost-effective, equitable and sustainable. Many nations have the ability to produce their own biofuels derived both from agricultural and forest biomass and from urban wastes, subject to adequate capacity building, technology transfer and access to finance.

Trade in biofuels surplus to local requirements can thus open up new markets and stimulate the investment needed to promote the full potential of many impoverished countries.

This vision also responds to the growing threat of passing a tipping point in climate system dynamics. The urgency and the scale of the problem are such that the capital investment requirements are massive, and more typical of the energy sector than the land use sectors. The time line for action is decades, not centuries, to partially shift from fossil carbon to sustainable live biomass.

The Sustainable Biofuels Consensus calls upon governments, the private sector, and other relevant stakeholders to take concerted, collaborative and coordinated action to ensure sustainable trade, use and production of biofuels, so that biofuels may play their key role in the transformation of the energy sector, climate stabilization and resulting worldwide renaissance of rural areas, all of which are urgently needed.

Summary of Recommendations

- Integrate and better coordinate policy frameworks
- Assess benefits and impacts of biofuels trade, use and production, and monitor them
- Address negative indirect effects of biofuels trade, use and production
- Reward positive impacts and investments, including through carbon management
- Use informed dialogues to build consensus for new projects
- Increase investment in research, development and demonstration
- Build capacity to enable producers to manage carbon and water
- Make sure that trade policies and climate change policies work together

Context

Biofuels are emerging in a world increasingly concerned by the converging global problems of rising energy demands, accelerating climate change, high priced fossil fuels, soil degradation, water scarcity, and loss of biodiversity. For instance, in its Fourth Assessment Report (2007), the Intergovernmental Panel on Climate Change - IPCC - identified that in order to avoid more than an acceptable maximum 2.0-2.4 ^{o}C rise in mean global temperature, greenhouse gas - GHG - emissions will need to peak around 2015 and be reduced well below 50% of 2000 levels by 2050. Subsequent peer reviewed research suggests that a lower figure is needed which cannot be achieved by emissions reduction alone.

Hence the need is for carbon removals giving rise to enhanced supplies of biomass raw material and the potential of biofuels related investments to show a profit from biofuels sales revenues.

The enormity of this challenge and the urgency needed should not be under-estimated. The impacts of climate change on agricultural productivity are unknown and could be seriously deleterious. The rate and scale of biodiversity degradation is significantly weakening the resilience of the natural world and its ability to deliver key services such as climate control, air and water purification and protection from natural disasters.

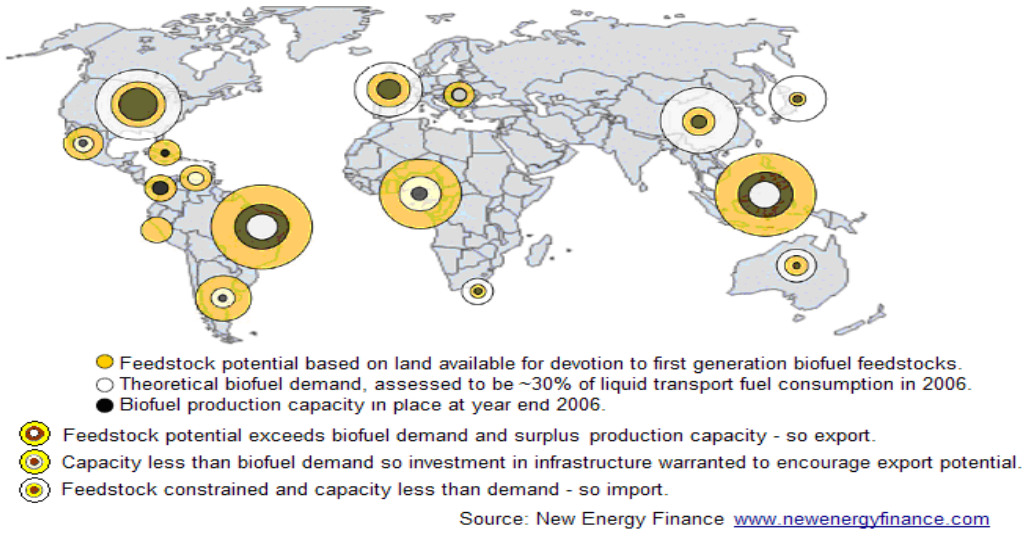
Biofuels are seen by some to be a panacea for a range of global energy, environment and rural development issues. However, there are “good” and “bad” biofuels depending on how they are traded, used and produced, which in turn determines their ultimate economic, environmental and social impacts.

Since most current modern biofuels are made from food crops, concerns about arable land use competition, risks to food security, vulnerable communities, water resource constraints, and deforestation arise. Meanwhile new crop feedstocks are being developed and advanced biofuel production methods using forest, crop, and urban residues, as well as from non-food crops, are also progressing, but have yet to be commercialized and deployed in the marketplace on a large scale comparable with the size of the energy market.

Many countries have a competitive advantage in producing biofuels. Meanwhile, many other countries are unable to meet their biofuel needs from domestic sources (Fig. 1). Therefore, increased biofuel trade holds promise. Also, when bioenergy displaces fossil fuels, in transport and power generation, or is produced in conjunction with soil carbon storage in the form of bio-char for example, opportunities arise for trade in carbon emission reduction units.

Figure 1. Indication of first generation biofuel feed stock potentials, theoretical biofuel demands and production capacities in place at end of 2006 for selected world regions.

(Areas of circles depict approximate comparative scales).



Towards a Sustainable Global Biofuels Market

Future biofuel markets could be characterized by a diverse set of supplying and producing regions. From the current fairly concentrated supply (and demand) of biofuels, a future international market could evolve into a truly global market, supplied by many producers, resulting in stable and reliable biofuel sources. This balancing role of an open market and trade is a crucial precondition for developing biofuel production capacities worldwide.

While domestic mandates ensure the existence of markets, they can also further distort markets for energy and agricultural products. The co-existence of mandates with other policy instruments such as subsidies, tariffs, import quotas, export taxes and non-tariff barriers have not always resulted in effective deployment and efficient production and can restrict the opportunities that biofuels present.

The current negative image of biofuels in some quarters, provoked in part by a rather complex set of national public support schemes, is threatening the fulfillment of their promise and must be addressed. Paramount to a solution is an orderly and defined schedule for elimination of subsidies, tariffs, import quotas, export taxes and non-tariff barriers in parallel with the gradual implementation of sustainable biofuels mandates. These measures will provide the necessary conditions to reduce risks and to attract investment to develop and expand sustainable production. Several different efforts to reach these goals are ongoing including multilateral, regional, and bilateral negotiations, as well as unilateral action. Ad hoc public and private instruments such as standards and product specifications and certification may also prove useful for addressing technical and sustainability issues. In addition, the development of a global scheme for sustainable production combined with technical and financial support to facilitate compliance, will ensure that sustainability and trade agendas are complementary.

Actions and Stakeholders

Considering the urgency of the challenges currently facing the global community, the authors of the Sustainable Biofuels Consensus offer the following recommendations to policy makers, trade negotiators, businesses, NGOs and other relevant stakeholders:

Integrate and better coordinate policy frameworks

This requires:

- coordinating national and international action among key sectors involved in biofuel development and use, including agriculture, energy, environment, transport;
- negotiating a schedule to gradually eliminate the tariff and non-tariff barriers to biofuels trade;
- agreeing on internationally compatible fuel quality technical standards whilst recognizing that several countries are already engaged in efforts to harmonize these standards;
- transparency in blending and other regulatory requirements at national and sub-national levels;
- reviewing policies in agriculture, energy and other sectors that contribute to inefficient production and market distortions in biofuels and their feedstocks; and
- adopting local, bilateral, regional and/or other frameworks for biofuels trade agreements with the objective of collaborating with existing frameworks (for example the UN Framework Convention on Climate Change; and the G8 established Global BioEnergy Partnership) to achieve convergence towards a comprehensive international land use improvement agreement.

Assess benefits and impacts of biofuels trade, use and production, and monitor them

This requires:

- agreeing on sustainability principles and criteria that include effective, mutually agreed and attainable systems, via means such as certification, consistent with World Trade Organization (WTO) rules;

- recognizing that several key international efforts are already underway both in governmental and non-governmental contexts and that an iterative review of such criteria should be undertaken in order to continually raise the standards through advances in knowledge from research and through experience gained in the field;
- harmonizing life-cycle analysis - LCA - methodologies for biofuels, including GHG life-cycle accounting methodologies, recognizing that efforts both at the international and national levels are already under way;
- continued mapping of degraded and marginal land; and
- continued mapping of carbon stocks, areas rich in biodiversity, and other high conservation value areas. Transparency, accessibility and application of these maps need international agreement and must have sufficient resolution such that small scale farmers are not excluded. It is recognized that efforts to map carbon stocks are being stimulated by the IPCC and undertaken by several other global land use mapping organizations but they must be better coordinated.

Address negative indirect effects of biofuels trade, use and production

As with other sources of energy, agricultural and forest products, and urban wastes, biofuels have positive and negative impacts. In an ideal world, sustainability criteria would be applied to all food, feed, fiber and all energy production and thus put biofuels on a level playing field with fossil fuels. Until such a system exists, there will be an excess of indirect positive and negative impacts on conservation areas, GHG balances, and food security from land use change, as well as price variations specifically associated with biofuels.

Addressing indirect impacts explicitly requires:

- continued global research to identify and quantify links between biofuels and land use change;
- mechanisms to promote biofuels that do not have negative land use change impacts;
- mechanisms that mitigate these negative impacts but do not unduly increase transaction costs for producers; and
- social safeguards, at national level, that ensure that vulnerable people are not disadvantaged through food and energy price increases and other potential negative economic side effects.

Reward positive impacts and investments, including through carbon management

Enhanced market opportunities will open up capital in order to follow the most profitable business models. Some benefits from biofuels use do not have an associated income stream. Therefore even sustainable trade as outlined in this document will not necessarily flow to the best performers. Under-funded benefits fall into the categories of:

- rural and social development;
- ecosystem services, including biological carbon fixation and water resource management; and
- better practices that might reduce crop yields but restore ecosystem health, such as conservation agriculture.

Rewarding better practice will require:

- using existing and innovative tools to ensure that markets reward environmental and social performance, including carbon sequestration, without additionality requirements;
- recognizing that the post-Kyoto regime will possibly reward biological carbon fixation, and this should be encouraged;
- ensuring that biofuels development is accomplished by shared benefits, rights and rules of law;
- recognizing that biofuel projects that create significant rural and social development benefits will likely be under-invested in due to difficulties in integrating smallholders into markets, tendencies to concentrate buying power within supply chains, and a lack of financial markets for small producers;
- understanding that many business models exist that equitably share benefits throughout the supply chain, especially at the farmer level. National policies, bilateral agreements, foreign assistance, and international financial institutions should give preferential treatment to these types of production systems to the extent feasible and to projects that encourage development of small scale production and regional biofuels markets; and
- acknowledging the link between bioenergy and rural development for improving rural incomes and abating poverty and thus providing a basis for increased investment and more efficient and sustainable agriculture.

Use informed dialogues to build consensus for new projects

Promoting an informed and continuous dialogue engaging all relevant stakeholders is key to ensuring equitable distribution of benefits of biofuel projects, and to addressing other elements of sustainability. It is particularly important to encourage biomass producers, both farmers and foresters, into the dialogue. To be effective, these dialogues must be translated into the allocation of public and private budgets to meet the consensus achieved on priorities for specific projects and R, D & D portfolios.

Increase investment in research, development and demonstation

While countries could consider other climate related initiatives besides biofuels, the goals of public and private R, D&D investments related to biofuel trade, use and production should include (but are not limited to):

- to produce cost effective second generation biofuels;
- to enable sustainability lessons learned from first generation biofuels to be used for second generation;
- to increase conversion technology performance;
- to maximize climate change mitigation;
- to evaluate the costs and benefits of increasing soil carbon content through such means as bio-char production and application; and
- to increase crop productivity and improve ecosystem health through management techniques, improved mechanization, water management, precision farming to avoid wasting fertilizers and agro-chemicals, and plant breeding and selection.

Build capacity to enable producers to manage carbon and water

Capacity building programs are needed for farmers, foresters and small and medium-sized enterprises active in bioenergy and biosphere carbon management systems, such as biochar soil improvement techniques and water management technologies. Capacity building is also needed for the development of effective technology innovation systems involving research and education, extension, industrial capacity to participate in joint ventures with supportive government agencies and an engaged civil society.

Make sure that trade policies and climate change policies work together

This will include Official Development Assistance - ODA -, national subsidies and payments, etc. There is a need for a clear commitment for national climate change policies, including those that

promote biofuels, to be additional to ODA. This is best achieved by climate change policies that drive direct foreign investment by energy sector players, in harmony with trade policies and sustainability requirements. Guided by national stakeholders' consensus, ODA should focus on helping to initiate and develop the institutions needed for sustainable rural development and *(Contd)*

respective business models, and support countries in defining and meeting sustainability requirements. In connection with biofuels development, ODA should also partner with development and UN agencies such as UNFAO, UNCTAD, UNDP, UNEP and UNIDO and the private sector to help in reducing transaction costs of sustainable development schemes.

Frequently Asked Questions

How much biomass is used today?

- Total biomass contributed around 10% to meet the 470 EJ[11] world primary energy demand in 2007, but mainly in the form of traditional non-commercial biomass[12] (Fig. 2). Commercial biomass is used to provide heat and electricity as well as liquid biofuels for transport.

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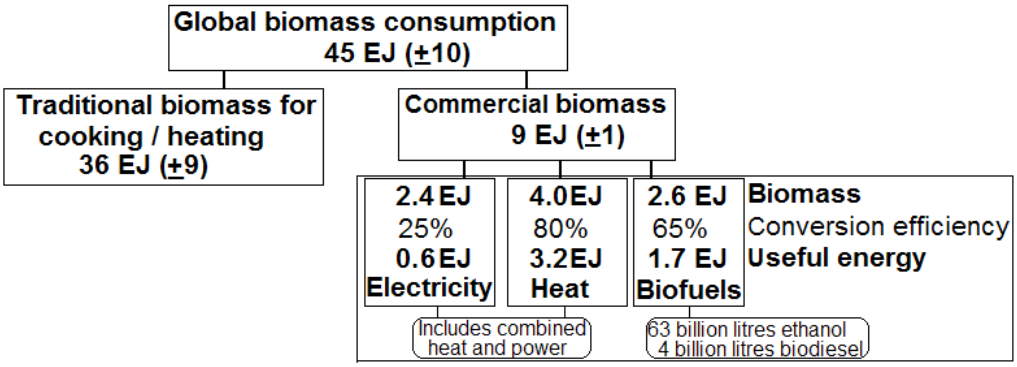
Figure 2 Contribution of biomass to global primary and consumer energy supplies in 2007



- Liquid biofuels currently supply around 1-2% of global transport fuels. The potential exists to significantly increase this share in coming decades but substantially displacing petroleum fuels only with strong and credible drivers
- The relative share of biofuels could be increased if a range of demand-side efficiency measures effectively reduce total fuel demand growth in the transport sector.

How much land is needed?

[11] One ExaJoule equals 10^{18} Joules or approximately 164 million barrels (or 22.7 million metric tons) of oil equivalent

[12] In future some bioliquid fuels such as ethanol gels and dimethyl ether (DME) could be produced as clean-burning, affordable and convenient substitutes for inefficient traditional solid biomass combustion used in rural areas of the developing world.

- Of the 13.2 billion hectares (bn ha) of the world's total land area, 1.5 bn ha are used to produce arable crops and 3.5 bn ha are in pasture for meat, milk and wool production. Crops currently used specifically for biofuels, as a result of farmers' choice, utilize only 0.025 bn ha. In Brazil, for example, over 40% of total gasoline demand is provided by ethanol produced from sugarcane grown on 1% of the 320 Mha of arable and pasture land.
- In addition to biofuel production, crops used for energy often also provide co-products such as animal fodder, fertilizers and electricity.

How much biomass could become available for producing biofuels?

- The future potential for biomass could reach 150-400 EJ/yr (up to 25% of world primary energy) by 2050 using available farm, forest and urban residues and by growing perennial energy crops.
- Some of the 1 bn ha of marginal and degraded lands unsuitable for food production (such as from rising salinity levels) could be reclaimed for productive use by growing selected energy crops.
- There are competing uses for non-food biomass resources (including for heat, co-firing and biofuels, as well as for bio-materials and bio-chemicals). Global trade in biofuels could help compensate for regional differences in the availability and accessibility of biomass resources.

Food versus fuel?

- Recent agricultural commodity price increases for the most part can be attributed to factors unrelated to biofuel production. These are increasing food and fodder demand as such, speculation on international food markets and incidental poor harvests due to extreme weather events. Also, high oil prices and related high costs of fertilizers have an impact on the price of agricultural commodities.
- Low productivity in agriculture in many regions has resulted in unsustainable land-use, erosion and loss of soils, deforestation and poverty. Increased productivity over time as a result of better farm management, new technologies, improved varieties[13], energy related capital investment and capacity building would gradually increase the intensity of land use so that sufficient land becomes available the meet the growing demand for food, feed, fiber and biofuel production.

Can biofuels support the agricultural sector and help meet the goal of sustainable development?

- Commercial biofuels markets could become a major factor in raising the economic viability of rural enterprises, especially in developing countries. Increased investment in infrastructure for biofuel processing, distribution and transport would also result. At least some of this infrastructure will also contribute to the overall development of the agricultural sector
- "Second generation" biofuel technologies produced from non-food ligno-cellulosic feed stocks are expected to become commercially viable on large scale, and hold considerable promise, compared to "first generation" biofuels, particularly for expanding the energy base and providing significant GHG emission reductions.
- Over time, first generation biofuels are likely to become more GHG efficient and co-exist with second generation biofuels as they are further developed. Tropical and sub-tropical regions will continue to enjoy comparative advantages in producing cost effective feedstocks for both.

[13] Through the Alliance for a Green Revolution in Africa (AGRA), the Rockefeller Foundation, in association with Bill and Melinda Gates Foundation, is supporting the development of 400 new crop varieties in order to reduce hunger and poverty.