OPAG 3

Implementation/Coordination
Team 3.1
TOR Member Reports

- Each ICT member was assigned to report on a TOR for the MG meeting and the CAgM.

- Four of 6 members completed the reports.

- RA-I  B. Chipindu;
  RA-II  A. Kashyapi;
  RA-V   A. Ishak;
  RA-VI  P. Falloon.
Workshop on Climate Change Impacts and Adaptation to Agriculture, Forestry and Fisheries at the National and Regional Levels, 18-21 November, 2008, sponsored by WMO, USDA, & Southeast Climate Consortium (SECC).

The goals: to develop recommendations to improve climate-based technology for agriculture, and to promote extension and outreach programs for farmers and policy-makers which enhance users’ familiarity with the new seasonal climate forecasts and decision aids, including user feedback mechanisms.
16 papers were presented during the one-day session.

Breakout sessions for both SECC and WMO/CAgM ICT meetings were held for two days.

Joint Meeting of SECC Executive Committee and WMO/CAgM ICT then re-convened on the last day to review SECC report and ICT recommendations.

SECC topics: Climate; Decision Analysis; Agricultural Research; Agricultural Extension; Water Resources Research; and, Water Resources Extension.
Climate and Climate Change (CC) Issues:

- Forecasts of extreme events for CC analysis
- Standard protocol and datasets, especially for CC scenarios
- Seasonal forecasts and assessments based on dynamic models
- Real-time climate data for updating tools in agro-climatic analysis
- Updated outlooks and forecasts in agro-climatic analyses
- Analog years needed for future scenarios
- Seasonal downscaled model results needed for climate assessments
- Decadal downscaled model results needed for climate assessments
Decision Analysis Issues:

- Meeting needs of socially disadvantaged farmers
- Needs of municipal water managers for climate information
- Vulnerability assessments for climate
- Formal assessment of stakeholder needs and interests in climate change information
- Need to retain emphasis on seasonal climate variability
- Develop new tools to calculate carbon footprint and water footprint.
Agricultural Research Issues:

- Agricultural drought – irrigation management, county-level water use estimation, drought indices, pasture and forage management tools, crop model linkages.
- Crop model improvement – estimation of input parameters, uncertainty analysis, pest models including generic indices for pest and disease risk.
- Climate Change issues – biofuels, carbon footprint analysis, stakeholder assessment, need appropriate scenarios for assessment and adaptation, need to maintain emphasis on sound science and publications.
- Decision Support Tools – disease management, GDD updates, drought indices
Agricultural Extension Issues:

- Improved, widely used climate & agricultural outlooks
- Strong engagement of agricultural extension service
- Availability of educational materials on-line
- Priority issues: Drought indices, DS tools, insect & disease indices, heat stress, water management, weed management
- Need more on-farm trials
- More information to farmers about crop models
OPAG 3/ICT 3.1
Research Recommendations

- Enhance the national predictive capabilities, and the relevant preventive and mitigating mechanisms associated with climate change in agriculture.

- Conduct research to identify highly vulnerable environments and communities, and provide them with coping strategies.

- Conduct research on the development of precision farming technology to ensure an efficient utilization of resources, especially water and nutrients in crop production.
OPAG 3/ICT 3.1
Research Recommendations

- Develop scenarios based on daily values for agricultural impact assessments.

- Revise agroecological zoning, where necessary, in light of projected climate change.
Strive to provide climate forecast information that is accurate, timely, useful and relevant for different climate-sensitive activities in agriculture including advisories for the farmers on the onset/length of the growing season, sowing dates, rainfall amount and distribution.

Promote farmer adoption of seasonal to inter-annual climate forecasts, but there is a need to generate quantitative evidence of their usefulness eg., cost-benefit analysis.
Climate Forecasting Recommendations

- Encourage investigations of the usefulness of seasonal and decadal forecasts to support adaptation planning through downscaling seasonal to decadal forecasts and improving their skill for precipitation and extremes.

- Enhance climate forecasting applications in natural disaster management through collaborative research with other physical and social sciences.
Capacity Building Recommendations

- Promote and sustain national scientific capacity through improved access to technical and financial resources to strengthen climate monitoring and predictive capabilities.

- Improve the capacity to develop early warning systems, drought risk management, climate monitoring etc.

- Encourage staff and student exchanges in the applications of seasonal forecasts in agriculture.

- Collect and disseminate information on technology transfer, indigenous knowledge and farmer training programs to identify and scale up good management practices.
OPAG 3/ICT 3.1

Agriculture Recommendations

- Improve technologies for efficient management of land, water and crops in the light of the changing farm environment.

- Promote the implementation of agricultural practices that are consistent with the principles of the sustainable development: minimum tillage, agro-silvo-pastoral systems, intercropping, rotation, use of residues etc.

- Promote more active participation of local communities through more effective information delivery and communication systems, taking into account the sources of information they use, consider and trust.
Recommendations – Farmer Adaptation

- Promote implementation of adaptation strategies such as:
  - Improved varieties that resist heat, drought, pests and diseases
  - Changes in cropping patterns
  - Afforestation
  - Improved water and land management
  - Diversification into non-farm activities
  - Crop insurance
  - Improved management of or access to markets and finance (e.g., microcredit)
Recommendations – Farmer Adaptation

- Develop and recommend ways to best use the information already available to promote on-farm decision making, and adapt to climate change by:

  1) Strengthening, consolidating and updating recommendations on “best practices” for applying climate model data in impact assessments; and,

  2) Promoting robust adaptation measures based on the skill and confidence of the guidance/advice from these climate projections across agriculture, forestry and fishery sectors.
Inter-Regional Workshop on Indices and Early Warning Systems for Drought

- From the Beijing Workshop recommendations, an Inter-Regional Workshop on Indices and Early-Warning Systems for Drought was held at the University of Nebraska (UNL) from 8-11 December, 2009.

- Sponsored included WMO, US National Drought Mitigation Center & UNL School of Natural Resource, NOAA, USDA, and UNCCD.
Inter-Regional Workshop on Indices and Early Warning Systems for Drought

Specific objectives were:

- Review & assess drought indices currently used around the world for meteorological, agricultural & hydrological drought;

- Review & assess strengths, weaknesses and limitations of existing drought indices and early warning systems;

- Develop consensus standard indices for all three drought types;

- Develop guidelines for implementation by members.
Inter-Regional Workshop on Indices and Early Warning Systems for Drought

- Approximately 65 participants from 23 countries, including all six WMO Regions, attended the workshop with over 30 presentations.

- Topics included:
  - Drought indices and Early Warning Systems;
  - Drought Indices in Current Use: Regional Perspective;
  - Impacts of Drought;
  - Hydrological and Agricultural Droughts;
  - Drought Monitoring: Current and Emerging Technologies; and,
  - Breakout Sessions to Develop Consensus Standard Indices for Different Types of Droughts
Inter-Regional Workshop on Indices and Early Warning Systems for Drought

- Breakout Sessions to Develop Consensus Standard Indices for Different Types of Droughts:

- For Meteorological Drought, top recommendations included:
  - SPI
  - Percentile Ranking
  - PDSI
  - Percent of Normal

- The use of drought indices that are based on a sound statistical and historical perspective (SPI and Percentiles) are most recommended. The SPI is considered the highest ranked.
Breakout Sessions to Develop Consensus Standard Indices for Different Types of Droughts:

For Hydrological Drought, top recommendations included:

-- Reservoir Level (managed)
-- Percent of Normal Rainfall
-- SPI
-- Composite Hydro Index
-- Low Flow Index

Composite hydro index should be based on stream flow, precipitation, reservoir levels, snowpack, and groundwater levels.
Breakout Sessions to Develop Consensus Standard Indices for Different Types of Droughts:

- For Agricultural Drought, top recommendations included:
  - Soil Moisture Index (measured or calculated)
  - Percent of Normal Precipitation
  - NDVI
  - Water Balance Index
  - Heat Stress Index

A total of 18 indices were identified in this session that could be used for agricultural drought monitoring.
WMO/UNISDR Expert Group Meeting on Agricultural Drought Indices

- WMO and International Strategy for Disaster Reduction (ISDR) co-organized an expert group meeting on agricultural drought indices for early warning systems, hosted by Hydrological Confederation of Segura, in Murcia, Spain on June 2-4, 2010.

- A major recommendation of the Lincoln Declaration included the establishment of two working groups by the end of 2010, with the primary objective of recommending standardized indices for global use to cope with agricultural and hydrological droughts.

- The expert team in Murcia convened to specifically address agricultural drought indices.
WMO/UNISDR Expert Group Meeting
on Agricultural Drought Indices

- Agricultural drought depends on soil moisture and evapotranspiration deficits.

- Thus, agricultural drought indices should be based on soil moisture and evapotranspiration deficits and should help effectively monitor agricultural drought.

- A drought index should integrate various parameters like rainfall, temperature, evapotranspiration (ET), runoff and other water supply indicators into a single number and give a comprehensive picture for decision-making.
There is a need to consider all critical aspects that contribute to incidence of droughts and their impacts in the agriculture sector.

A consensus agricultural drought index should help explain not only the degree of severity of droughts, but also assist policy makers in taking early actions to alleviate their impacts.
Consequently, depending upon available data and resources, the meeting recommended that a composite agricultural index is the best means of achieving a standard consensus index.

Until the resources are available for the composite index, a simple index incorporating rainfall and soil moisture should first be adopted, then water balance index should be tiered into the agricultural drought indexing methodology. Finally, as the data and resource become available, a composite agricultural drought index should be adopted as a standard for monitoring the onset, severity, and end of agricultural drought.
Expert Team 3.2
Climate Risks in Vulnerable Areas: Agrometeorological Monitoring and Coping Strategies
Simone Orlandini
Composition of the team

Simone ORLANDINI, University of Florence (Italy), Leader

Mduduzi Sunshine GAMEDZE, National Meteorological Service (Swaziland) REGION 1

Arif GOHEER, Global Climate Change Impact Studies Centre (Pakistan) REGION 2

Yonel MENDOZA VEREAU, Ministerio de Agricultura Direccion General de Informacion Agraria (Peru) REGION 3

Ward SMITH, Agriculture and Agri-Food Canada (Canada) REGION 4

Andres WATKINS, National Climate Centre Bureau of Meteorology (Australia) REGION 5

Vesselin ALEXANDROV, National Institute of Meteorology and Hydrology (Bulgaria) REGION 6
OPAG 3 ET 3.2

- Symposium on Climate Change and Variability – Agro-Meteorological Monitoring and Coping Strategies for Agriculture.
- Oscarsborg, Norway; 4 -6 June 2008
- Organizers: COST 734 (Impacts of climate change and variability on European agriculture) and WMO CAgM
- Local Host: Bioforsk - the Norwegian Institute for Agricultural and Environmental Research
- Quarterly Journal of the Hungarian Meteorological Service published 14 journal articles from this symposium.
Book of abstract and special issue
OPAG 3 ET 3.2

Recommendations

- **Determination of Critical Areas for Climate Change and Variability**
- Strengthen climate variability/change monitoring; improve decision support systems and seasonal climate prediction at local and regional level.
- Foster greater national/international/regional cooperation in the field of climate variability/change.
- Improve and utilize adaptation and mitigation options for agriculture under climate variability/change scenarios.
- Bring science to society by transferring relevant and meaningful climate variability/change and related impact research results to policy makers, stakeholders, end-users and the broad community.
Recommendations

- **Current Status of Strategies for Mitigation, Adaptation and Sustainability**
- Develop a portfolio of agricultural strategies, including adaptation, mitigation, new technologies and research.
- Integrate mitigation and adaptation frameworks into sustainable development planning on a priority basis.
- Assess long-term consequences of mitigation and adaptation strategies in agriculture and determine how these actions are affected by climate.
- Integrate agricultural systems with renewable energy systems such as wind, solar and hydroelectric power.
- Ensure that developing countries play an increasing role in mitigation and adaptation planning.
- Reduce the types of agriculture production which require large amounts of energy inputs per unit of food to substantially reduce GHG emissions.
OPAG 3 ET 3.2
Recommendations

- **Coping with Climate Risks and Foreseen Impacts in Agriculture**
- Ensure closer connection between studies of greenhouse gas emissions and climate change impacts.
- Make sure that coping strategies address both positive and negative impacts.
- Regionalize climate change impact studies through organizations, such as Cost Action, since climate variability is increasing and varies in different regions.
- Promote the establishment of knowledge circles at different levels (scientists, decision makers and farmers at the local, regional, and national levels).
- Reinvigorate agrometeorological and related agricultural research in the light of climate change.
Recommendations

- **Current Capabilities in the Analysis of Climate Risks and Adaptation**

- Conduct a comprehensive review of the existing drought indices, and recommend a limited set of indices that are universally acceptable for the needs of different regions.

- Translate the current knowledge on floods and landslides into operational management systems that government and agencies could adopt.

- Adapt the current heat-wave warning systems for humans to crops/cropping systems.

- Develop cost effective frost operational systems, and raise awareness among the farmers about the frost damages.
Recommendations

- **Current Capabilities in the Analysis of Climate Risks and Adaptation**
  - Undertake the assessment of the impacts of cyclones/hurricanes on agriculture, forestry and fisheries to develop operational early-warning systems for agriculture.

- Seasonal climate outlooks should also include forecasts for the risks of forest fire potential in many parts of the world, encourage the forest fire fighting community to be a part of the user community.

- Develop the most comprehensive information that could assist the locust-control community to address the increasing incidence of locusts.
Expert Team 3.3

Drought and Extreme Temperatures: Preparedness and Management for Sustainable Agriculture, Rangelands, Forestry, and Fisheries

Luiz Claudio Costa
EXPERT TEAM ON DROUGHT AND EXTREME TEMPERATURES: PREPAREDNESS AND MANAGEMENT FOR SUSTAINABLE AGRICULTURE, RANGELANDS, FORESTRY, AND FISHERIES REPORT

Four of six comprehensive regional reports submitted:

- RA-I A. Coulibaly
- RA-II M. Rahimi
- RA-III A. Mancuso
- RA-VI E. Cloppet
International Workshop on Drought and Extreme Temperature: Preparedness & Management for Sustainable Agriculture, Rangeland, Forestry & Fisheries was held in Beijing 16-17 February, 2009; followed by ET 3.3 meeting on 18-19 Feb.

More than 40 scientists from climate and agricultural research institutes, universities and environmental monitoring organizations participated in the workshop, jointly organized by WMO and CMA.

Sessions were organized by topics:

-- Drought Indices and Monitoring;
-- Drought Policies and Coping Strategies;
-- Extreme Temperatures; and,
-- Climate Change: Drought and Extreme Temperatures
OPAG 3 ET 3.3

Workshop Conclusions:

- There is an urgent need for standards for drought indices that can be practically applied to a wide-range of agricultural purposes across the world;

- Increasing temperatures and potential of lack of freeze events will likely have an impact on pest and disease ecology, and increase stress on forests.
Workshop/ET Recommendations:

- The WMO needs to make appropriate arrangements to identify the methods and to marshal the resources for the development of standards for agricultural drought indices in a timely manner.

- Other recommendations include:
  - More proactive drought planning;
  - Promoting the use of more water efficient coping strategies like drought tolerant crop varieties, water harvesting, and micro-irrigation techniques; and,
  - Using groundwater more efficiently for agriculture.
Workshop/ET Recommendations:

- Strengthen national capacities for collecting, processing and disseminating data/information on all natural disasters;

- Need to promote the use of crop insurance products;

- To make appropriate use of crop varieties based on climate variability/change;

- Imperative to improve the linkage between agricultural extension services and farmers;

- Need to develop precision models of impacts of future climate change on agricultural systems.
Thank You
Conclusions

- Observational evidence shows that agriculture, forestry and fisheries are now being affected significantly by climate change and more specific information on the nature of future impacts is now becoming available.

- Vulnerability to climate change can be exacerbated by the presence of other stresses such as population increase, poverty, degradation of natural resources, over-fishing etc., especially in developing countries.

- Many impacts can be avoided, reduced or delayed and vulnerability of affected communities can be reduced by implementing suitable adaptation measures.
OPAG 3/ICT 3.1
Conclusions

- There is a lack of appreciation and use of indigenous knowledge at the local level to reduce impacts and adapt to climate change.

- There are obstacles in using the recommended adaptation practices because of lack of attention to possible social disruptions while changing traditional customs and in an environment of political and economic instability.

- Despite the need for climate friendly farming technologies, there is a clear lack of research and education targeted towards subsistence farming and lack of guidance on climate change adaptation.
Conclusions

- There is confidence with GCMs’ projections for temperature but uncertainty in regional (seasonal) precipitation and climate extremes. GCMs have some incomplete/missing processes and feedbacks e.g., vegetation, carbon cycle etc., GCMs do not simulate climate variability well e.g., ENSO, monsoons, ITCZ etc.

- There is a lack of useful Regional Climate Models (RCMs) and downscaling of climate change scenarios for local applications as well as capacity to use them particularly for small islands (SW Pacific, Caribbean, North Pacific, Indian Oceans), South America, and Africa.

- Current research and development (R&D) activities, especially in the developing countries, are insufficient in understanding and developing strategies to reduce the impacts of ENSO-induced climate variability.
OPAG 3/ICT 3.1
Conclusions

- In recent years, significant advances have been made in the development of seasonal to inter-annual climate forecasts, but their operational applications in agriculture have been hampered by lack of information on the accuracy, timing, interpretation, understandability and communication in local languages.

- Traditional insurance markets and informal lending systems in villages are inadequate in preparing for climate change. There is a lack of risk management tools eg., insurance markets, for agriculture, forestry and fisheries, in particular in developing countries.

- Currently, the government policies to address climate change impacts and adaptation measures are inadequate to meet the urgent need for climate change adaptation.
Dr. Kashyapi completed the report focusing on: To review and coordinate the activities of the OPAG, as well as additional activities of priority to the Commission, in order to ensure their effective implementation and adoption within Member countries.

The report presented a synopsis overview of the impacts, vulnerability, and adaptation of climate change for agriculture in different regions based on the IPCC Fourth Assessment Report.

He concluded the report by stating that a greater understanding the global and regional adverse impacts of climate change are needed; sustainable development can reduce vulnerability; and, indigenous knowledge is essential at the local level.
Mr. Ishak completed the report: To summarize the status of climate change/variability studies as they impact national and regional agriculture, forestry and fisheries.

The report focused on issues in Southeast Asia, the WMO RA-V member countries. (A request for information had been sent via the WMO website, with less than 5% response: UK, Malawi, Malaysia, Uzbekistan, Slovenia, Sweden, Hungary, Hong Kong, New Zealand, Australia and USA).

In Southeast Asia, R & D studies for TOR (B) are not well established. Special focus devoted to: enhancing national predictive capabilities; climate change-agricultural production interactions; plant breeding & biotechnology for varieties resistant to water stress; precision farming technology; water-savings technology; and, strengthening early warning systems.
Dr. Falloon completed the report: To appraise and report on current capabilities in the analysis of climate change/variability specifically as they relate to and affect agriculture, forestry and fisheries at the national and regional levels.

The report is based on the IPCC Working Group 1 Fourth Assessment Report (AR4).

Results include:

- Ensure that systematic climate model errors/limitations are addressed in climate model projections;
- Enable improvements in climate model skill where biases are large;
- Since climate extremes and seasonal changes are crucial in ICT sectors, more information on skill and confidence is required;
- More studies on sea level rise, storm surge and TCs are needed;
- The lack of downscaling studies for many regions needs to be addressed;
- Develop clear, robust sources of guidance on “reliability” of climate projections; and, climate model validation specific to agriculture.
Mr. Chipindu completed the report: To identify deficiencies in the operational applications of long-range predictions for agriculture, and to make recommendations for improving the technology for the benefit of agriculture at the national and regional levels.

The report highlights significant operational problem issues:

- Timing of information delivery;
- Large spatial and temporal model resolution;
- Insufficient parameters to meet farmers’ decision requirements;
- Farmers’ perceptions of usefulness of the climate forecasts;
- Effective communication of climate forecasts/products to users requires training of intermediaries to translate probabilistic forecasts into easily understood language for farmers.
- Need to produce, package & disseminate timely, useful product
Dr. Gameda, RA-IV, did not submit a report for TOR(D)
Mr. Moreno, RA-III, did not submit a report for TOR(F)