

***Workshop on Climate Change Impacts and Adaptation to Agriculture,
Forestry and Fisheries at the National and Regional Levels***

Orlando, Florida, USA

18- 21 November 2008

**Title: Climate Change/Variability as It Impacts National and Regional
Agriculture, Forestry and Fisheries in Southeast Asia**

**Paper Presented
By**

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Climate Change/Variability as It Impacts National and Regional Agriculture, Forestry and Fisheries in Southeast Asia

- Introduction
- Focus Areas: Southeast Asia and WMO RA-V member countries
- Climate change/variability as they impact national and regional agriculture, forestry and fisheries
 1. Malaysia / ASEAN
 2. New Zealand
 3. Australia
 4. United Kingdom (based on previous task)
- Conclusion and Recommendations



Introduction

- **Structure of, CAgM-IV of WMO**
 - 3 Open Programme Area Group (OPAG)
 - OPAG 1** : Agrometeorological Services for Agricultural Production
 - OPAG 2** : Support Systems for agrometeorological Services
 - OPAG 3** : Climate/Change and Natural Disasters in Agriculture



Goal of OPAG 3

- To summarize, analyze, and report on the status of climate climate/variability studies, mitigation, adaptation strategies and methodologies to reduce of natural disaster impacts, and help improve the utility of long-term climate predictions in agriculture.



- **This paper focused on one of the Terms of Reference (TOR) of the Implementation and Coordination Team (ICT) on Climate Change/Variability and Natural Disasters in Agriculture (ICCND) under the OPAG 3**
- **The task is**
 - **to summarize the status of climate change / variability studies as they impact national and regional agriculture, forestry and fisheries.**
 - **Relate this task to climate change/ variability impacts on Agriculture, Forestry and Fisheries in Southeast Asia ~ RA V member countries.**



- Initial Request to all the WMO RA through Permanent Representative with WMO
- < 3 % responded
 - United Kingdom Meteorological Office
 - Malawi
 - Malaysia
 - Uzbekistan
 - Slovenia
 - Sweden
 - Hungary
 - Hong Kong
 - New Zealand
 - Australia
 - A paper by Dr Raymond Motha, OPAG 3 CAgM-XIV Chairperson
 - **Nevertheless some useful information can be drawn from those research papers abstract.**



Focus Areas: Southeast Asia - the WMO RA-V member countries

- **Poor feedback from ASEAN countries and the Pacific Islands**
- **Very encouraging corporation from Australian Bureau of Meteorology and the President of CAgM-XIV, Dr J. Salinger from National Institute of Water and Atmospheric Research (NIWA) representing New Zealand.**



Climate Variability in Southeast Asia- Prospective of Malaysia

- The El Nino induced weather change has resulted in prolonged dry season, which has led to severe drought, haze and increased temperatures
- For the last twenty years, the incidence of abnormal weather variation has been more frequent and rampant, brought up predominantly by El Nino
- The El Nino episode of 1997/98
 - As for Malaysia
 - total losses to agriculture due to the El Nino were estimated to be more than RM 3.3 billion.
 - The hardest hit was the palm oil industry with estimated losses of RM 2,651 million
 - Rubber - RM 357 million
 - Rice - RM 218 million.



Haze Episode, El Nino 1997/1998

- Research by CGPRT Centre (The Regional Co-ordination Centre for Research and Development of Coarse Grains, Pulses, Roots and Tuber Crops in Humid Tropics of Asia and the Pacific)
 - Estimated for haze related damage in Malaysia
~ US\$ 210 million
- World Fund for Nature ~ US\$6 billion world-wide
- EEPSEA: Economy and Environment Program for Southeast Asia
 - US\$310 million was incurred in Malaysia
 - US\$63 million in Singapore
 - US\$1,012 million in Indonesia.



CGPRT Centre: Research sponsored by Japanese Government

- The CGPRT Centre had implementing a three years research project " Stabilization of Upland Agriculture and Rural Development in El Nino Vulnerable Countries“
- Collaboration with partners from five countries: ASEAN (Indonesia, Malaysia, the Philippines, Thailand) and Papua New Guinea.
- Publication of "Stabilization of Upland Agriculture under El Nino Induced Climate Risk: Impact Assessment and Mitigation Measures in Malaysia" (CGPRT Centre WORKING PAPER No.61)
- "Stabilization of Upland Agriculture under El Nino-induced Climate Risk: Regional and Farm Level Risk Management and Coping Mechanism in the Kedah-Perlis Region, Malaysia" (CGPRT Centre WORKING PAPER No. 70).



Institutional Preparedness, Malaysian involvement to reduce the adverse impact of El Nino induced weather change.

- 1. Climate monitoring and forecasting**
 - 2. National Air Quality Monitoring Program**
 - 3. Water Resource Management**
 - 4. Research and Development**
 - 5. New Water Resource**
 - 6. Policy Measures**
- 

Institutional Preparedness

1. Climate monitoring and forecasting

- The United Nation declared that thousands of human casualties and billions of dollars in economic damage will continue to befall the world's developing countries every two to seven years until major investments are made to improve the existing forecasting and preparedness for El Nino.
- Malaysian Meteorological Department responsible in monitoring and forecasting the climate variability and air quality in Malaysia. Specifically, in relation to El Nino incidence



Institutional Preparedness

2. National Air Quality Monitoring Program

– monitors atmospheric conditions

- the Air Pollution Index
- visibility index
- Total Suspended Particulate (TSP)
- other pollutants measurement such as carbon monoxide, sulphur dioxide, nitrogen dioxide
- ozone.



Institutional Preparedness

3. Water Resource Management

– continued monitoring of water resource

- application of recycled water for water conservation
- an efficient water distribution mechanism
- appropriate water schedules management



Institutional Preparedness

4. Research and Development

1. **Development of drought resistant paddy varieties**
gene bank ~broad spectrum of rice germplasm, currently totaling about 9,000 accessions
2. **Water saving technologies- introduced which optimize water used efficiency**
3. **Haze and crop growth -introducing zero burning during replanting operation**
4. **New Water Sources - issues of inter-state and inter-basin water transfer.**



Institutional Preparedness

5. New Water Resource

issues of inter-state and inter-basin water transfer.

6. Policy Measures

- a. National Policy on the Environment, which was promulgated to ensure long-term sustainability and improvement in the quality of life
- b. The Environmental Quality Act (1974) was amended to provide stricter regulation and stiffer penalties to ensure the maintenance of air quality in the country
- c. the National Haze Action Plan, Regional Haze Action Plan, the ASEAN Cooperation Plan on Trans-boundary Pollution,
- To address the problems of fire and smoke.



Climate change/variability as they impact national and regional agriculture, forestry and fisheries in New Zealand

- Received from the President of CAgM-XIV, Dr J. Salinger from National Institute of Water and Atmospheric Research (NIWA) representing New Zealand
- Summary of the potential impacts of climate change to agriculture, forestry and fisheries mostly based on *climate projections* for New Zealand



Impacts on agriculture

- Cropping
 - Impacts of climate change on pests, diseases and weeds, and their effects on crops, remain uncertain since few experimental or modeling studies have been performed (Chakraborty *et al.*, 2002).
 - In New Zealand, for C₃ crops such as wheat, the CO₂ response is likely to more than compensate for a moderate increase in temperatures (Jamieson *et al.*, 2000).



Impacts on agriculture

- **Horticulture**

- Production of current kiwifruit varieties is likely to become uneconomic in Northland by 2050 because of lack of winter chilling, and be dependent on dormancy-breaking agents and varieties bred for warmer winter temperatures in the Bay of Plenty (Kenny *et al.*, 2000). In contrast, more areas in the South Island are likely to be suitable
- Apples, another major crop, are very likely to flower and reach maturity earlier, with increased fruit size, especially after 2050 (Austin *et al.*, 2000).
- Higher CO₂ levels increase vine vegetative growth and subsequent shading is likely to reduce fruitfulness



Impacts on agriculture

- **Pastoral and Rangeland Farming**
 - In western, southern and higher altitude areas of New Zealand, higher temperatures, a longer growing season, higher CO₂ concentrations and less frost are very likely to increase annual pasture production by 10 to 20% by 2030
 - In eastern New Zealand and Northland, pasture productivity is likely to decline by 2030 due to increased drought frequency.



Impacts on Forestry

- In New Zealand, the growth rates for plantation forestry (mainly *P. radiata*) are likely to increase in response to elevated CO₂ and wetter conditions in the south and west.
- Tree growth reductions are likely for the east of the North Island due to projected rainfall decreases and increased fire risk.



Impacts on Fisheries

- Little research has been completed on impacts of climate change on freshwater fisheries and aquaculture
- The key variables expected to drive impacts on marine fisheries are changes in ocean temperature, currents, winds, nutrient supply, acidification and rainfall
- Changes in four emergent biological properties are likely as a result of climate change, the first of which is best understood: (i) distribution and abundance of impacted species; (ii) phenology; (iii) community composition; and (iv) community structure and dynamics (including productivity).
- Changes in sea-surface temperature or currents are likely to affect the distribution of several commercial pelagic (e.g. tuna) fisheries in the region



Climate change/variability as they impact national and regional agriculture, forestry and fisheries in Australia

- The papers, articles and scientific abstract picked up were prepared by Mr. Stephen Lellyett, Deputy Regional Director NSW of BOM and member of CAgM-XIV, OPAG1, ICT for Agrometeorological Services.
- The papers is about Australia, or written by Australian authors and the staff at the Bureau of Meteorology
- 400 various scientific abstracts and without abstracts, papers and articles received – difficult to do the summary
- Listed few

Impact on Agriculture

- Climate change and the economics of farm management in the face of land degradation
- Using southern oscillation index (SOI) phases to forecast crops yields
- Global change impacts - Costs and benefits of CO₂ increase and climate change on the Australian wheat industry
- Monitoring and predicting agricultural drought
- Survey of farmers' attitudes, management strategies and use of weather and seasonal climate forecasts for coping with climate variability.
- Climate predictions for better agricultural risk for profit and resource management
- Evaluation of the impact of Long-Range Climate Forecasting on the physical and financial performance of wool production - Constraints and opportunities



Impacts on Fisheries

- Studies have shown that reefs are under threat from 'coral bleaching' outbreak. Status of coral bleaching and decadal changes in community structure of coral reefs due to climate change and climate variability on the Great Barrier Reef are being carefully monitored and updated.
- Environmental Variability in the High Sea Ecosystem of the Indian Ocean: From Climate and Biological Indices to Tuna Fisheries Response.
- Effects of seasonal and inter annual variability of the climate ocean environment on recruitment to the fisheries of Western Australia and Tasmania.
- Potential impacts of climate change on coastal fisheries.
- The seasonal aggregation of whale sharks at Ningaloo Reef, Western Australia: currents, migrations and the El Nino/Southern Oscillation



Impacts on Forestry

- The biodiversity crisis and adaptation to climate change: a case study from Australia's forests.
- Impact of climate change and atmospheric carbon dioxide concentration on the growth of planted forests



Climate change/variability as they impact national and regional agriculture, forestry and fisheries in the U. Kingdom

- This brief summary is solely based only on a list of paper titles contributed by Dr Peter FALLOON from the Meteorological Office, Hadley Centre for Climate Prediction and Research member of CAgM-IV OPAG3. ICT.



Impacts on agriculture

- More focus on modeling and soil carbon
 - Integrated modeling of the effects of climate change
 - Integrated approaches to climate-crop modeling: needs and challenges
 - The GEFSOC soil carbon modeling system©: a tool for conducting regional-scale soil carbon inventories and assessing the impacts of land use change on soil carbon
 - A dynamic modeling system for estimating changes in soil carbon from mineral soils at 1km scale in the UK
- Soil



Impacts on Forestry

- Offset of the potential carbon sink from boreal forestation by decreases in surface albedo
- Biogeophysical effects of land use on climate: model simulations of radiative forcings and large-scale temperature change
- Global climate change and soil carbon stocks; predictions from two contrasting models for the turnover of organic carbon in soil
- Impact on Fisheries - NA



Conclusion and Recommendations

- Unlike developed countries, the study of climate change/variability as they impact national and regional agriculture, forestry and fisheries in Southeast Asia region and other developing countries is not well established
- Research and Development (R&D) activities are critical in providing technical support and possibilities of reducing the effect of El Nino induced climate change and other climate variability



Conclusion and Recommendations

- Special focus must be given to the following research areas:
 - Towards enhancing the national predictive capabilities, an interaction between climate change, agricultural production and the relevant preventive and mitigating mechanisms must be established, such as in the form of an expert system and modeling
 - Research should continue on plant breeding and biotechnology for the development of varieties resistance of water stress and related technologies in view of the possible limitation of water available for agricultural purposes in the future.
 - Research on the development of precision farming technology should be enhanced to ensure an efficient utilization of resources, especially water in crop production



Special focus must be given to the following research areas

- Future variability in climate will most likely result in different sets of problems with regard to pests and diseases. An effective control method and preventive measures under an entirely different farm environment must be developed. Similarly, the changing of farm environments necessitates the development of related technologies for land and water management, crop management and post harvest management.
- Emphasis should continue on the development of water saving technology, including the possibility for greater utilization of recycled water, in view of the impending shortages in irrigation water in the future, especially during future El Nino episodes.



Special focus must be given to the following research areas

- Improved access to technical and financial resources to strengthen national scientific capability of the relevant departments and institution to strengthen their monitoring and predictive capabilities. A bigger pool of scientists, research funds and facilities for research on environmental sciences and other relevant disciplines must be established as part of national capacity building.
- Establish a coordination and planning committee at national level specially to address issues related to climate variability and climate change. The committee could serve as a coordinating body to identify and mobilize national capacity to strengthen R&D activities in line with national priorities and needs.



Thank You

