Climate Change – Reducing Agriculture and Forestry Vulnerability
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- Climate – Past present and future
- Climate impacts on agriculture
- Climate forecasting
- Management practices
- International workshop
- Conclusions
Climate – Past, present and future

- Global temperatures have increased by about 0.6°C over the 20th century.
- Very likely that the 1990s was the warmest decade, 1998 the warmest year.
New analyses of proxy data for the Northern Hemisphere indicate that the increase in temperature in the 20th century is likely to have been the largest of any century during the past 1000 years.

It is likely the Northern Hemisphere that the 1990s was the warmest decade, and 1998 the warmest year.
Climate – past, present and future

(b) Temperature change

- Scenarios:
  - A1B
  - A1T
  - A1FI
  - A2
  - B1
  - B2
  - IS92a

- Several models all SRES envelope
- Model average all SRES envelope

Bars show the range in 2100 produced by several models.
Climate – past, present and future

“Global average temperature and sea level are projected to rise under all IPCC SRES scenarios”

From IPCC, 2001
Climate Variability

The El Niño/Southern Oscillation

- Year-to-year variability between El Niño and La Niña
- A 3 - 5 year climate cycle of global importance driven out of the Pacific Basin
Climate Variability

ENSO Impacts
Climate extremes

- Global average water vapour concentration and precipitation are projected to increase, with larger year to year variations very likely.
- More hot days and fewer frost days are very likely.
- More heavy rainfall events are likely over many areas.
- Increase in tropical cyclone peak wind intensities are likely over some areas.
Climate Impacts on Agriculture

- A general reduction in potential crop yields in most tropical and subtropical regions with increases in temperature.
- Arid and semi-arid tropics has low and variable rainfall
- A reduction, in potential crop yields in most mid-latitude regions
- Increases in some mid-latitude regions for smaller temperature increases
- A potential increase in global timber supply from some managed forests
Climate Impacts on Agriculture

- Ranges of % changes in crop yields spanning various scenarios
- Each pair of results shows with and without adaptation
Climate Forecasting

- Based on slow variations, mostly oceanic
- Seasonal time scale
- Large spatial scales
- Climate somewhat chaotic
  - a limit to predictability
  - statistical/probabilistic predictions
- History often a fair guide
Climate Forecasting

Observations

- ENSO State
- Climate patterns

Background

- Climatology
- ENSO Climatology

Expert Assessment

- Regional, seasonal & rain (WWW)

Forecasts

- ENSO forecasts
- Global forecasts
- Analogue selection
- MSLP, R forecasts

Tailored products
Climate Forecasting - Benefits

- Extremes constrain land use
- Information on “average” climate alone is inadequate
- Extremes likely to change with Global Warming
- Growth in climate forecasting to assist with seasonal extremes
Climate Forecasting - Applications

- Farm level - when to plant sorghum when the SOI is ‘consistently deeply negative’

- Which variety of wheat to plant using climate forecasts of the risk of late frosts.
Climate Forecasting

- Simulate management scenarios using analogue years
- Evaluate outcomes/risks relevant to decisions

Agricultural Production Systems Simulator (APSIM) simulates

- Yield of crops and pastures
- Key soil processes (water, N, carbon)
- Surface residue dynamics & erosion
- Range of management options
- Crop rotations + fallowing
- Short or long term effects
Climate Forecasting

Seasonal Climate Forecasts

- Irrigation
- Fertilisation
- Fallow practice
- Land prep
- Planting
- Weed management
- Pest management

- Improved Planning for wet weather disruption - season start and finish
- Crop size forecast
- CCS, fibre levels
- Civil works schedule

- Land & Water Resource Management
- Environmental Management

- Crop size forecast
- Early Season Supply
- Supply Patterns - Shipping
- Global Supply

Business and Resource Managers

- Improved Planning for wet weather disruption - season start and finish
- Crop size forecast
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- Land & Water Resource Management
- Environmental Management

- Crop size forecast
- Early Season Supply
- Supply Patterns - Shipping
- Global Supply

Government

- Water allocation
- Exceptional Events

Scale Axis

Information Axis

Targeted

General

Farm

Harvest, Transport, Mill

Catchment

Marketing

Policy

APN

NIWA

Taihoro Nukurangi
Traditional Management Practices

Natural Mulches

- Moderates soil temperature and extremes
- Less evaporations occurs conserving soil moisture
- Less erosion
- Suppresses diseases and harmful pests
Traditional Management Practices

Intercropping

- Provides some shading and better water utilization
Traditional Management Practices

Shade Cropping and Agroforestry

- Modifies wind, water availability, etc.
Education

- Computer Aided Learning
- Crop-Climatene Matching
- Crop growth/development models and indices
- Internet Technologies
- Risk assessment climate forecasting
Research

- Commence climate adaptation research
- Understand climate impacts on agriculture
- Model climate change impacts on agriculture
- Improve spatial measurement of crops
Knowledge on climate variability and change

Impacts of present and future variability on agriculture and forestry

Impacts of global warming on agriculture and forestry

Adaptation strategies used in the 20th century

Seasonal to interannual climate forecasting

Use of traditional methods for reducing vulnerability

Use of new technologies for reducing vulnerability

Research, training and education
Implications - Hazards

Natural Hazards - Heavy Rain and Drought

- Changes in rainfall intensity and extremes need to consider flood protection, sewerage and storm water systems
- Sea level rise impacts on lower flood plains
- For drought need to manage stocking and rural fire protection
Implications - Agriculture

Agriculture

- Climate proofing of activities, especially pastoral farming to account for extremes from seasonal predictions
- Planning new activities as the climate shifts and warms
Implications - Crops

Crops

- Extremely sensitive to variability and change
- Shifts in crops ranges
- Manage between good and adverse seasons
- Plan new activities as climate shifts and changes
Conclusions

Reducing Vulnerability:
Whatever we do, climate change is inevitable during the 21st century
The rate of climate change will be rapid

Integrating preparedness for increasing climate variability and change

UK Met Office Climate Model
2050 - 2060