Water Resources in a Changing Climate: A risk management approach

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Science for Decision Makers
• Australia’s highly variable climate and its impact on agriculture

• Climate change and a risk management approach

• Bureau of Rural Sciences tools to support risk management
Area of Australia Under Agriculture

• Agriculture covers about 60% of Australia (4.5 M Km^2)

• Murray-Darling Basin (MDB) covers 14% (1M Km^2), produces 40% by value of total farm output

• Contains 25% of the nation's cattle, 50% sheep, 50% cropped land

• 0.4% of agricultural land is irrigated – 95% in MDB

• 25% gross value (50% profits) from irrigation
The 2001-2007 Drought
Including El Niño in 2002/03 & 2006/07

Red colours show 5th & 10th percentile rainfall, Blue 90th percentile

www.brs.gov.au
inflow for 2006/07
Murray-Darling Dam Storage Levels

Water storage in the MDB (New South Wales and Victoria)

- 4983GL

12 May 2008

23 May 2006

31 May 2007
Impact of Drought

Source: ABARE Outlook 2007
Trend in Annual Total Rainfall 1950-2006 (mm/10 years)
Risks and Opportunities for Farmers

Farm business / enterprise

Markets (inputs, outputs, assets)
Labour
Climate
Transport
Technology
WTO
Government policy
Legislation
A Risk Management Approach

1. Establish priorities – what is the goal for your farm business?
2. Identify the **climate** risk – what might impede you achieving your goal?
3. Analyse the **climate** risk – what’s the likelihood of this impediment happening?
4. Evaluate the **climate** risk – what can you do to mitigate the risk or exploit opportunities? Relative costs and benefits?
5. Treat the **climate** risk – implement your decision
On-line:

• **National Agricultural Monitoring System (NAMS)**
  National-scale monitoring

• **Multi-Criteria Analysis Shell (MCAS-S)**
  Spatial decision support

• **MLA Rainfall to Pasture Growth Outlook Tool**
  Seasonal forecasting

• **Rainfall Reliability Wizard**
  Intra- and inter-seasonal rainfall reliability
In Development:

• **Water 2010 - National Water Balance Information for Policy and Planning**
  Strategic planning and scenario testing

• **Climate Change Wizard**
  Investigating shifts in climate reliability
National Agricultural Monitoring System (NAMS)

National-scale, near-real-time monitoring of climate, natural resources and agricultural production

NAMS provides near real time information on land use, soils, rainfall, farm commodity production, etc. etc.

Reports are available on-line at various scales and formats.

Used in drought assessment and in assisting farmers to understand their situation in an historical context.
4.2. Access To Water

Irrigation Allocations
The following figure shows a timeseries of initial and final irrigation allocations for the major irrigation areas in the region.

Historic Rice Production - Time Series
The following figure shows a time series of rice tomato production within the EC report region.
Multi-Criteria Analysis Shell for Spatial Decision-making (MCAS-S)

Spatial decision support

• MCASS enables rapid combination and evaluation of overlapping mapped data (economic, environmental, social) for management decision making

• An example is the intersection of grazing pressure of animals (stock / feral / native) with vegetation cover, rainfall reliability and erosion data

• Identifies at any scale, areas of greatest overall pressure and potential impact for the factors assessed
MCAS-S

Identifies natural resource stress: eg grazing pressure and rainfall reliability in the Australian rangelands
MCAS-S

Multiple factor combinations
Climate Change Wizard

Intra- and inter-seasonal rainfall reliability

Investigates whether shifts in climate thresholds critical to agriculture are already occurring.

Similar Total Winter Rainfall in East & West locations:
- East: 207mm
- West: 195mm

Similar Probability of Receiving at Least 75% (150mm) of Rainfall Over Three Month of Winter:
- East: 31%
- West: 34%

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"Bar-Code" Analysis of Reliability

Western Location Reliability Decreasing

Eastern Location Reliability Unchanging

Reliability defined as probability of receiving 75% of average rainfall in each month
MLA Rainfall to Pasture Growth Outlook Tool

Seasonal forecasting of pasture growth based on current soil moisture and ocean temperature conditions

MLA Rainfall to Pasture Growth Outlook Tool

- Projects the likelihood of rain, soil moisture and pasture growth, three months into the future at 3500 rainfall gauge sites

- Updated weekly

- Based on comparison of 130 year historical record

- Comparison at sites based on analogue years when sea surface temperatures on both coasts of Australia were similar to the current year
Water 2010 - National Water Balance
Information for Policy and Planning

Investigating the consequences of likely or desired changes in climate, land use, land management and population growth on water resources
**H₂O¹⁰ provides a total water balance at 5 km grid resolution across Australia**

- Covers rainfall, recharge of groundwater, evaporation, transpiration, consumptive use, etc
- Allows scenario analyses of changes to be evaluated
Concluding remarks

• Australia has a highly variable climate – global warming adds additional uncertainty

• Impacts are significant in production, economic and social terms

• Climate change adaptation strategies will be determined by individuals – Autonomous, rather than Planned adaptation

• A risk management approach places climate variability (and change) in the context of other risks to business

• The role of government is to assist in enhancing decision-making and adaptive capacity

• BRS on-line tools support decision-making by farmers and policy makers through provision of relevant, real-time information