Drought preparedness, drought contingency planning and farm risk management.

Dr Roger C Stone and Dr Holger Meinke: University of Southern Queensland. Queensland Department of Primary Industries and Fisheries. Queensland Department of Natural Resources and Water.
Aim of the talk:

• Rationale for this approach.
• Setting the scene using Australia as a case study region.
• Drought preparedness and contingency frameworks.
• Information on which to base decisions.
• Policies and institutional arrangements.
• Risk management measures for decision makers.
• Case study examples of actions taken by decision makers.
• Some concluding remarks.
Why?

• “Past attempts to manage droughts and their impacts through a reactive, crisis management approach, have been ineffective, poorly coordinated, and untimely.

• Because of the ineffectiveness of the crisis management approach there has been increasing interest in the adoption of a more proactive risk-based management approach.

• An interesting aspect is that these actions are partly due to the apparent more recent occurrence of drought episodes or of more severe droughts in some instances” (Wilhite).
And,

“Drought planning and water crisis management needs to be proactive. This is largely because overall policy, legislation, and specific mitigation strategies should be in place before a drought or water crisis affects the use of the country’s water resources. “
Basic elements involved in proactive drought contingency planning (Bruins, 2001).
• Drought impact assessments have to be made of the impact of drought on the various water resources, economic sectors, population centres, and the environment. Different types of drought should be considered in the impact assessment studies.

• Drought scenarios have to be calculated on the basis of available information, including development of a frequency and severity index.

• From this, drought risk assessment can be investigated, primarily on the basis of meteorological data but may also include paleoclimatic information and other historical data in relation to climatic variation.
To set the scene: RAINFALL VARIABILITY

Variability of Annual rainfall

(100 years of data for Australia and generally also for the other countries)

<table>
<thead>
<tr>
<th>Country</th>
<th>Coefficient (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>18</td>
</tr>
<tr>
<td>S. Africa</td>
<td>15</td>
</tr>
<tr>
<td>Germany</td>
<td>12</td>
</tr>
<tr>
<td>France</td>
<td>11</td>
</tr>
<tr>
<td>NZ</td>
<td>9</td>
</tr>
<tr>
<td>India</td>
<td>8</td>
</tr>
<tr>
<td>UK</td>
<td>8</td>
</tr>
<tr>
<td>Canada</td>
<td>7</td>
</tr>
<tr>
<td>China</td>
<td>6</td>
</tr>
<tr>
<td>USA</td>
<td>5</td>
</tr>
<tr>
<td>Russia</td>
<td>4</td>
</tr>
</tbody>
</table>

(Love, 2005)
Impact of El Niño on yields: probability of exceeding long-term median wheat yields for each wheat producing shire (= district) in Australia. (Example of output for July 2001 and July 2002, respectively).
Wilhite (2003; 2005) identified four key components for effective [drought] risk reduction strategy. These are:

• The availability of timely and reliable information on which to base decisions,

• Policies and institutional arrangements that encourage assessment, communication, and application of that information,

• A suite of appropriate risk management measures for decision makers,

• Actions by decision makers that are effective and consistent (case studies).
Information on which to base decisions:
Information on which to base decisions:

The National Agricultural Monitoring System:

- Publicly available climatic, production, and commodity information for agricultural industries at national, state/territory, and regional scales – online and at your fingertips.
- User-friendly and easy to read maps and graphs available for local regions throughout Australia.
- Reports can be generated for a range of purposes, including seasonal conditions, regional profiles, and drought assessments.
- Designed to streamline the application and assessment processes for Exceptional Circumstances (drought assistance), initially for dryland/broadacre industries.

www.nams.gov.au

The NAMS is a collaborative project between Australian, State, and Territory governments.
Information to base decisions:

**U.S. Drought Monitor**

October 10, 2006
Valid 8 a.m. EDT

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://drought.unl.edu/dm

**Drought Impact Types:**

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)

Released Thursday, October 12, 2006
Author: Rich Tinker, Climate Prediction Center, NOAA
Pasture Growth Relative to Historical Records from 1957
October 2004 to September 2006

Information on which to base decisions

www.LongPaddock.qld.gov.au
Information on which to base decisions? – state drought declarations based on state drought policy
Information on which to base decisions? – federal drought declarations based on federal drought policy
Levels of assistance

Information to help decisions? Drought policy issues: from Rudwick (2006)

Exceptional Circumstances

State Government Drought Assistance Programs

Self Reliance
(Government programs to enhance self reliance)

Frequency of seasonal conditions (one in....year event.)
Note: Not to scale
Forecasting the Australian Grain Crop; example of a fully integrated agrometeorological system

Rainfall up to date and Climate Forecast

Information to base decisions: use of models

Crop Outlook

Spatial Statistics

Drought Probability

Simple Agro-climatic model

Geographical Information System

(Potgieter, 2003)
Information to base decisions: use of models
Case study example from RSA: An integrated climate-farming/cropping systems forecast system that aid preparation for drought

Probability (%) of exceeding maize yields of 2.5 t/ha

Planting date: 1 November
(Cons –ve SOI phase)

Planting date: 1 November
(Cons +ve SOI phase)

(Potgieter, 1999)
Information on which to base decisions: use of a pasture model (current model outlook)
Sow date & SOI Phase

Yield (kg/ha)

15-Sep Negative
15-Oct Negative
15-Nov Negative
15-Dec Negative
15-Jan Negative

Preparedness information on which to make a decision: DSS ‘Whopper Cropper’ – integrates climate forecasting, crop simulation modelling, and agronomic information.
Preparedness information - use of seasonal forecast information to aid drought preparedness – depends strongly on the management options available to the farmer to take advantage of such forecasts.
Institutional support for risk management measures – use of Decision-support systems – ‘example of GrazeOn’ that helps pastoralists with risk management measures

- estimating stocking rate
- pasture budgeting
- monitoring
- total grazing pressure
- drought preparation
Support for risk management measures: *GrazeOn* can deliver

- encourages *monitoring* to be used as a tool to direct and influence property management.
- assists *early decision making* in relation to stock numbers by identifying, in advance, when pasture will run out.
- assists *animal and pasture record keeping*. 
What does *GrazeOn* offer for management problems?

- objective methods to estimate quantity of pasture
- requirements of animals in relation to feed quality and quantity
- extent of non-domestic grazing pressure and its demand on forage supply
Risk management: What does *GrazeOn* offer for management problems?

- climate forecasting and pasture growth models enable forward budgeting of pasture
- assist preparedness and contingency planning for drought and reduce risk by forward budgeting of pasture (for up to 2 years)
Tools for managing climatic risk

- **Drought Plan Products**
  - **Drought Alert Products**
  - RISK HERD (integrated analytical model)
  - Decision-Tree Analysis
  - RANGE PACK
  - BREEDCOW-DYNAM and Stockup
  - GRAZPLAN
  - FEEDMAN and Feedup
  - * GRAZE-ON Stocking Rate Calculator
  - * BB-SAFE
  - GRASSMAN and Beefup
  - * Carrying Capacity Calculator
  - * PSD: Pasture Supply and Demand Calculator
  - Internet — "The Long Paddock"
  - GRASP — Grass Production Calculator and Scientific Models
  - * Feed Shortage Alerts
  - ** Land Condition Alerts
  - ** ‘Managing for Climate’ PMP Workshop
  - AUSTRALIAN RAINMAN
  - ** SOI Hotlines and Climate Outlook
  - Farm Fax
  - PASTURE CHECK
  - Property Records
  - Property Management Planning — Introduction Module

Improving Management Decisions

Climate  Pastures & Animals  Economics  Integrated Risk Management
Case studies: Actions by decision makers - financial strategies for drought contingency planning

• Increasing short term debt (working capital) - (the proportion of farms that increased their working capital during 2002-03 was substantially higher in the ‘exceptional circumstance’ regions in all states compared to previous years).

• Running down liquid assets and use of financial reserves – (significant declines in the average holding of farm liquid assets during the 2002-03 El Niño ($131,000 to $91,000 per farm).
• However, these changes are likely to have significantly altered the extent to which many rural producers can now prepare for future extreme drought events.

• Controls and restrictions over imports of grain or feedstuffs for use in livestock industries mean those farmers and producers that utilise imported grain are much more likely to be exposed to the adverse effects of severe droughts compared with the exposure of local grain growers.
Case study - actions by decision makers - James Clark and fellow farmers from northern New South Wales

Use of seasonal forecast systems by farmers in terms of the decisions that have already been made over a number of years as part of their drought preparedness and contingency planning.
• Continual monitoring of long-term predictions of La Niña and El Niño through use of preferred web-sites (e.g. United States Climate Prediction Centre – National Oceanic and Atmospheric Association (NOAA) weekly updates and coupled model outputs plus USDA sites….
• NOT forward selling their crops in likely coming drought periods to prevent ‘locking-in’ to contracts they cannot meet.

• Installing deep soil moisture-seeking equipment in order to tap into any deeply located moisture.

• Use of 100-year crop simulations and the ‘APSIM’ crop simulation model that has the capability to integrate crop simulation modelling with climate forecasting systems.
• Developing appropriate crop rotation strategies, sowing rates, fertiliser rates, and row configurations for the coming likely drought.
• Farmers in this case study continue to concentrate on ‘fine-tuning’ their crops for both likely drought and non-drought periods with the result they have been able to double their yields and double their profits over a recent eight year period.
Innovative weather and climate risk management using derivative trading

Roger Stone, Peter Best Alexis Donald,
Queensland Department of Primary Industries and Fisheries
Improved financing of contingency funding?

- Yield - WAGGAMBA Shire
- Average SOI May–Oct
HOWEVER: FROM A POLICY POINT OF VIEW

• Coordination between the different sectors, agencies, or individuals involved in the response planning may be poor (or impossible).

• The process from policy development to effective drought preparedness and contingency planning may not be effective or well thought out with the result that little effective drought preparedness or mitigation actually takes place by the farmer or industry.

• As Davies (2001) points out ‘there is more to contingency planning than simply drawing up a document’.

• Additionally, contingency planning must be strong enough to withstand the pressures of crisis and relief operations. Contingency planning must continually be reinforced, must involve local people, personnel must be trained, and flexible responses must be field tested in advance of emergency situations (Davies 2001).
### Implementation of specified drought preparation strategies in Queensland, by industry

<table>
<thead>
<tr>
<th></th>
<th>Extensive livestock</th>
<th>Intensive livestock</th>
<th>Cropping</th>
<th>Horticulture</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Livestock strategies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Destocking plans / had buying and selling strategies</td>
<td>75.4</td>
<td>48.7</td>
<td>41.2</td>
<td>14.3</td>
</tr>
<tr>
<td>Stored fodder / fodder facilities / forward fodder contract / machinery to push mulga</td>
<td>62.4</td>
<td>73.7</td>
<td>44.3</td>
<td>10.7</td>
</tr>
<tr>
<td>Improved or acquired more reliable livestock water / cleaning dams</td>
<td>61.7</td>
<td>47.4</td>
<td>24.4</td>
<td>6.3</td>
</tr>
<tr>
<td><strong>Plant industry strategies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopted flexible cropping system</td>
<td>16.3</td>
<td>30.3</td>
<td>73.3</td>
<td>37.5</td>
</tr>
<tr>
<td>Moisture conserving crop management strategies – eg. zero till, trash blanketing, mulching</td>
<td>15.8</td>
<td>28.9</td>
<td>71.0</td>
<td>50.9</td>
</tr>
<tr>
<td>Increased the efficiency of water use – eg, trickle irrigation / centre pivot / laser leveling</td>
<td>13.4</td>
<td>17.1</td>
<td>33.6</td>
<td>75.0</td>
</tr>
<tr>
<td>Improved or acquired more reliable irrigation water</td>
<td>9.1</td>
<td>21.1</td>
<td>33.6</td>
<td>46.4</td>
</tr>
<tr>
<td><strong>General strategies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm maintenance up to date</td>
<td>85.2</td>
<td>78.9</td>
<td>89.3</td>
<td>88.4</td>
</tr>
<tr>
<td>Used climate forecasts and seasonal outlook in management</td>
<td>47.4</td>
<td>38.2</td>
<td>59.5</td>
<td>41.1</td>
</tr>
<tr>
<td>Purchased or leased another property / agistment country lined up</td>
<td>20.8</td>
<td>21.1</td>
<td>11.5</td>
<td>10.7</td>
</tr>
</tbody>
</table>

*a* Extensive livestock includes beef and sheep farms; intensive livestock includes dairy, poultry and other livestock farms; cropping includes grain and cotton farms.

Issues related to climate change?

‘Some studies assessing future economic impacts of climate change on agriculture suggest that farmers will continue to produce the same commodities on the same land using the same management tools’ (Rogers and McCarty 2000; Abler et al. 2002).
•‘However, Schneider et al. (2000) note ‘Farmers in the real world will need to adapt to climate change trends embedded in a very noisy background of natural climatic variability’.

•‘This variability can mask slow trends and delay necessary adaptive responses by government agencies’.

‘Preparedness and contingency plans developed in response to anticipated climate change will need information on shifting market and social conditions which may render adaptive behaviour for climate change much more multi-faceted that may be assumed’ (Risbey et al. 1999; Schneider et al. 2000).
‘While, in some countries, research and development agencies continually monitor environmental trends, potentially leading to contingency planning and subsequent adaptive strategies, in other countries problems with agricultural pests, extreme weather events and lack of capital to invest in adaptive strategies and infrastructure may be a serious impediment to reducing climatic impacts for agriculture (Schneider, et al. 2000)’. 
'It is suggested a more focused and urgent effort be made world-wide to provide enhanced and targeted climate trend and scenario information that is of direct relevance and value to contingency planning policy.

This may especially be the case in developing countries where climate change may shift farming regions into increasingly more vulnerable farming zones’ (Rosenzweig and Parry 1994).
Summary:

• Risk management – drought preparedness and drought contingency planning require many information sources to be effective – and they have to be timely and reliable (key role for NMHSs and partnership organisations).

• Information policy aspects can easily lead to unnecessary complexities when different government agencies are involved (state vs federal).
• Use of simulation models, climate and weather forecasts plus DSS all help in the process – although the information suite can become very complex. Case studies seem to help users considerably (which then also helps government policy).

• ‘Farmers in the real world will need to adapt to climate change trends embedded in a very noisy background of natural climatic variability’.

• ‘This variability can mask slow trends and delay necessary adaptive responses by government agencies’.