A risk management framework for assessing climate change impacts, adaptation and vulnerability

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Purpose of Risk Management Framework Study

- climate change impacts are complex (McKeon et al. 2009)
- need for climate change assessment for grazing industry
- means of engagement with industry
- adaptation strategies need to begin now
- vulnerability assessment feedback can inform policy
- target research and development where knowledge is limited
- identifies adaptation short-term or restructure in long-term?
### The Risk Management Matrix approach

<table>
<thead>
<tr>
<th>Climate Change Factors</th>
<th>Pasture</th>
<th>Water</th>
<th>Animals</th>
<th>$</th>
<th>Graziers and Regional Communities</th>
<th>State and Commonwealth Government</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ ↑</td>
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<tr>
<td>Temperature ↑</td>
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<tr>
<td>Rainfall ↓</td>
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<tr>
<td>Interaction ↑</td>
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<tr>
<td>Natural Climatic</td>
<td></td>
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<tr>
<td>Variability ↑↑</td>
<td></td>
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</tbody>
</table>
### Impacts of climate change

<table>
<thead>
<tr>
<th>Feature of climate change</th>
<th>Pasture Growth</th>
<th>Tree-Grass Balance for Grazing</th>
<th>Surface Cover</th>
<th>Pasture Nutrition</th>
<th>Surface Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Elevated CO₂</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decrease in pasture growth (References 2a, 6a, 16a, 17h, 19b, 20a, 21a, 24a, 26a, 31a)</td>
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<tr>
<td>2. Increased evaporation</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
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<tr>
<td></td>
<td></td>
<td>Increase in pasture nutrition - Due to increased evaporation of nitrogen, but less during the growing season</td>
<td>Reduced in pasture nutrition (References 2a, 6a, 7a, 8a, 9a, 10a, 16a, 17a, 25a)</td>
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<tr>
<td>3. Higher minimum temperature</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
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<tr>
<td></td>
<td></td>
<td>Increased pasture nutrition - Only (References 19b, 26a, 27a)</td>
<td>Reduced in pasture nutrition (References 2a, 6a, 7a, 8a, 9a, 10a, 16a, 17a, 25a)</td>
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<tr>
<td>4. Less frost</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
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<tr>
<td>5. Higher maximum temperature</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
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<td></td>
<td>Decrease in pasture growth (References 2a, 6a, 16a, 17h, 19b, 20a, 21a, 24a, 26a, 31a)</td>
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<tr>
<td>6. More days over 35°C</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
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</tr>
<tr>
<td></td>
<td>Decrease in pasture growth (References 2a, 6a, 16a, 17h, 19b, 20a, 21a, 24a, 26a, 31a)</td>
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### Adaptation Responses and Vulnerability

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<tr>
<th>Feature of climate change</th>
<th>Pasture Growth</th>
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<th>Surface Cover</th>
<th>Pasture Nutrition</th>
<th>Surface Water Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Elevated CO2</td>
<td>Maintain cattle/sheep for pasture recovery; Monitor C3/C4 ratio (Reference: 5a, 9a, 18a, 20a, 22a, 23a, 27a, 32a, 31a)</td>
<td>Manage use of fire, chemical, animal controls (M) (Reference: 17h, 18a, 20a, 22a, 27a, 31a)</td>
<td>Manage cattle/sheep/fire to maintain existing cover; Maintain cattle/sheep for pasture recovery; (Reference: 9a, 23a, 27a, 32a)</td>
<td>Use supplements (N, P, energy) and rumen modifiers; Use early season growth and destock sooner; Lengthen recovery time of pastures; Use feedlots to finish animals; Use fertilisers and improved pastures (L) (Reference: 5a, 18a, 19b)</td>
<td>Partially offsets rainfall deficit</td>
</tr>
</tbody>
</table>

**Decrease cattle/sheep in the warm/dry season to maintain pastures, maintain groundcover to preserve soil moisture, tree strips to reduce landscape evaporation (M)** (Reference: 9a, 17h, 18a, 20a, 22a, 23a, 27a)

- Increase depth of existing dams; Fence dams and use controlled waters where possible (H) (Reference: 9a, 14a, 20a, 23a)
- Increase water storage facilities (M) (Reference: 9a, 14a, 20a, 23a)
- Increase volume and number of water storage facilities; Increase depth of existing dams; Fence dams and use controlled waters where possible (H) (Reference: 9a, 14a, 20a, 23a)
Preparing Risk Statements

Risk statements derived from risk analysis can identify:
- the nature and level of risk
- the need for, and timing of the response and
- the nature of useful adaptation responses

To achieve this:
- identify the areas with the greatest vulnerability
- prepare a risk statement for one aspect

For example:
- The extreme risk to the grains industry of more and prolonged high temperature events could lead to lost viability of grain enterprises….
- This level of risk requires an immediate response from….
- This risk can potentially be mitigated through….
Risk Management Matrix - a summary

Aim: to assess and report indications of risk (i.e. impacts, adaptation and vulnerability)

• with the involvement of industry and regional participants, this tool was developed to help regional stakeholders plan their adaptation strategies to potential climate change impacts

• the tool uses a risk management approach and can be adapted for use in any industry or sector

• a key feature is the participatory nature of the process used to tailoring the tool for each industry
Informing Industry of Risk Management Matrix approach:

• QCCCE in conjunction with Agri-Science Queensland (Department of Employment, Economic Development and Innovation; DEEDI)

• conduct five Industry briefings - Brisbane:
  - horticulture/forestry, grains/cropping, fisheries/aquaculture, beef/sheep/dairy, intensive livestock (pigs/poultry)

• conduct 10 regional briefings - regional Qld
  • Toowoomba, Roma, Longreach, Mt Isa, Cairns/Tableland, Townsville, Mackay, Rockhampton, Emerald, Bundaberg

• develop 13 regional fact sheets:
  - impacts, adaptations, historical and projected climate data
    – Industry focus
Industry and Regional Briefings

Industry briefings to date:
• pilot study: western Queensland (Grazing industry; 2008)
• horticulture/forestry (fruit & vegetable, forestry, turf)
• grains/cropping (grains, sugar cane, cotton)

Evaluation:
• 70% of participants found briefings useful in addressing climate change issues and understood the Risk Management Matrix approach
• 80% of participants recognised potential benefits of the Risk Management Matrix as an adaptation tool
• 70% of participants plan to use the Risk Management Matrix

Future:
ClimateQ funding rollout with training activities
ClimateQ
Helping primary producers adapt to climate change

- partnership with Agri-Science Queensland (DEEDI)
- $3.2 million to provide information and tools to help primary producers in Queensland manage climate change risks.
- provide regional level climate change projections to primary producers, peak industry groups and natural resource management (NRM) groups.
- provide primary producers with access to the tools and information they need to manage risks from a changing climate (e.g. Risk Management Matrix).
- deliver workshops to industry groups and NRM groups to build knowledge and skills in applying risk management tools and adaptation options.
- establish a Queensland network of scientists, farmers and agribusiness to continually evaluate the relevance and effectiveness of risk management tools and adaptation options.
Summary

The Risk Management Framework is a useful tool to:

• assess climate change impacts and adaptation
• identify areas and regions of high risk (i.e. vulnerability)
• link with bio-economic modelling
• be used for other regions and industries (ClimateQ)
• enhance understanding and facilitate education

Source Publication: