Resilience surfaces for pasture production under climate change scenarios

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Overview

1. Climate change projections
2. Resilience surfaces for pasture production
   - Impacts of incremental changes
   - Adaptation options
3. Limitations of approach
4. Conclusions
Climate change projections for southern Aust.

- Based on A1FI emissions (highest)
- Median and range of changes shown

<table>
<thead>
<tr>
<th>Year</th>
<th>Temperature (°C)</th>
<th>Rainfall (%)</th>
<th>CO(_2) conc (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2030</td>
<td>1.0 (0.6-1.5)</td>
<td>-3 (-10 to 0)</td>
<td>≈ 440</td>
</tr>
<tr>
<td>2050</td>
<td>2.2 (1.5-2.8)</td>
<td>-8 (-20 to +10)</td>
<td>≈ 550</td>
</tr>
<tr>
<td>2070</td>
<td>3.4 (2.2-5.0)</td>
<td>-10 (-30 to +10)</td>
<td>≈ 710</td>
</tr>
</tbody>
</table>

Source: Climate Change in Australia. Technical Report 2007
Approach to modelling climate change impacts

• **IF**... how will the climate change?
  – Warmer and drier across southern Australia.
  – But considerable uncertainty with rainfall.
  – Use a range of climate scenarios
    • Temperature scaled by 0, 1, 2, 3 and 4°C
    • Rainfall scaled by +10, 0, -10, -20, -30%
    • Atmospheric CO₂ concentration increased with temperature.

• **THEN**... what is the likely impact on pasture production?
  – Need modelling tools, like DairyMod.
Annual pasture growth in warmer & drier climates

Hamilton - perennial ryegrass, subclover

Pasture harvested (t DM/ha)

Temperature change (°C)

Rainfall change (%)

Warmer, Drier

Warmer, Higher CO₂

1971-2000
Annual pasture growth in warmer & drier climates

Hamilton - perennial ryegrass, subclover

Pasture harvested (t DM/ha)

2070 2050 2030

1971-2000

Drier

Warmer,

Higher CO₂
Growth rates under warmer and drier climates

Higher winter production

Contracted Spring

Historical climate
+1°C, -10% rain
+2°C, -20% rain
+3°C, -30% rain

Hamilton – perennial ryegrass, subclover
Adaptation to warmer and drier climates

- Select species/cultivars with:
  - Heat tolerance
  - Higher water use efficiency, deeper roots

C₄ grasses, like kikuyu, will become more productive as the climate warms.
• Projected changes in the variability of climate are not captured
  – Eg. increased precipitation intensity

• Grazing systems models do not consider plant persistence
Conclusions

• Approach allows exploration of a range of future climate scenarios
• Pasture systems are resilient to climatic changes projected over next 20 years.
• Trend towards:
  – higher winter production.
  – shorter spring seasons.
• Heat tolerance and water use efficiency will be more important as climate becomes warmer and drier.
Ellinbank pasture production in a temperate climate

Ellinbank, West Gippsland

Pasture harvested (t DM/ha)

Temperature change (°C)

Rainfall change (%)

1971-2000

Drier

Warmer

Legend:
- 7-8
- 8-9
- 9-10
- 10-11
- 11-12
Elliott pasture production in a cool temperate climate

Elliott, NW Tasmania

![Graph showing pasture harvested (t DM/ha) vs. temperature change (°C) and rainfall change (%)]

- **Pasture harvested (t DM/ha)**: The graph displays the amount of pasture harvested in different temperature and rainfall conditions.
- **Temperature change (°C)**: The x-axis represents the change in temperature, ranging from colder to warmer conditions.
- **Rainfall change (%)**: The z-axis represents the change in rainfall, ranging from drier to wetter conditions.

The graph highlights the impact of temperature and rainfall changes on pasture production for the period 1971-2000.