Adapting to the impacts of climate change: Australia on the front line

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Summary

• Recent extremes and their impacts
• Adaptation
  – Case study of Australia’s present-day urban water demand
• Future climate change and some impacts
January-February 2009

• Heatwave in Melbourne
• Bushfires in Victoria
• Queensland floods – 60% of the state under water
• Dengue fever in North Queensland
Heatwave 26 January - 1 February 2009, South-east Australia

- Three days in a row + 43°C
- 46.4°C at 15:05 on 30 Jan, the highest temperature recorded in Melbourne since weather records began in 1855
Minimum and Maximum temperatures

Melbourne City
January - February 2009

*Deaths data from BDM and reports to SCO
Impacts

• Premature deaths:
  – In the week 26 January to 1 February there were 374 premature deaths in Victoria
  – 1600 ambulance calls per day (2x normal rate)
• Power blackouts affecting 0.5 million households
• Transport – Connex train services
  – 24% of services over 28-30 Jan cancelled due to air-conditioning system failure/inadequacy, rail buckling, power blackouts.
  – $5 million bill for train cancellations
  – Free fare Friday (30 January), to compensate commuters, cost tax payers up to $2 million in forgone revenue

• Direct financial loss $100 million
• Indirect $300 - 400 million
Queensland floods

- Damage $234 million
- Some places under water for more than a month
- Flood levels in places 11-12 m
- Deaths fewer than 10
Insurance losses

Top 20 Insurance Disasters at January 2004

50% of events are hailstorms

All weather related except Newcastle earthquake

Insurance Council of Australia (2007)
Perth water supply

Hennessey et al., 2007, IPCC WGII AR4
Increasing supply

- Desalination plants
  - Potential for maladaptation
  - Perth plant uses wind energy
  - Gold coast uses ‘green’ energy
- Indirect potable reuse
- Managed aquifer recharge
  - Storage of wet season surplus
Demand management

• Through:
  – pricing,
  – technical changes and
  – educational campaigns

• Strongly reduced per capita demand

• Accommodated significant increases in urban population

• Deferred major supply augmentation
The carrot: QLD rebates

- Up to $1,000 for new rainwater tanks, including installation, pumps, diverters and slab.
- A $200 rebate for a new 4-star (or better) WELS water-rated clothes washing machine.
- A rebate of $150 per suite for new dual-flush toilet suites to replace existing single-flush toilet suites.
- Assistance with 50% of purchase and installation costs, of up to $200 for an aboveground greywater system or $500 towards the purchase and installation of a below-ground greywater system.
- Assistance with 50% of purchase price, up to $30 per showerhead, to replace existing showerheads with new 3-star (or better) WELS water-rated showerheads.
- Up to $200 for a swimming pool cover and/or roller.
The stick: Using too much?

- Penalties apply
- Excessive water user program
  - Households with a legitimate reason for high water use are exempt.
  - Excessive use means more than 800 litres per household per day or 200 litres per person per day if there are five or more residents.
  - The program includes the following steps:
    • Home notified of their excessive use through their Council’s normal billing process
    • Home notified again and asked to explain excessive use (homes with a legitimate reason for high water use will be excluded from the program)
    • Penalty (outdoor watering ban) applied if home continues to use water excessively (800 litres a day or 200 litres per person if there are five or more residents).
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<thead>
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<tbody>
<tr>
<td>Sydney</td>
<td>+15%</td>
<td>-16%</td>
<td>-7%</td>
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<tr>
<td>Melbourne</td>
<td>+38%</td>
<td>-6%</td>
<td>-12%</td>
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<tr>
<td>Newcastle</td>
<td>+27%</td>
<td>-23%</td>
<td>-14%</td>
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</tbody>
</table>
SE Queensland Domestic Water Use

Source: Andrew Ash, CSIRO
Future temperature changes

For Australia

2030: 0.6 to 1.5°C warmer for a medium emissions scenario

2070: 1.0 to 2.5°C warmer for a low emissions scenario

2070: 2.2 to 5°C warmer for a high emissions scenario

IPCC, 2007
## Future extreme temperatures

<table>
<thead>
<tr>
<th></th>
<th>Present (1971-2000)</th>
<th>2030 mid-range emissions</th>
<th>2070 Low emissions</th>
<th>2070 High emissions</th>
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<tbody>
<tr>
<td><strong>Canberra</strong></td>
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<tr>
<td>Days over 35°C</td>
<td>5</td>
<td>7-10</td>
<td>8-14</td>
<td>12-26</td>
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<tr>
<td>Days below 0°C</td>
<td>60</td>
<td>42-51</td>
<td>36-48</td>
<td>20-39</td>
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<tr>
<td><strong>Adelaide</strong></td>
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<tr>
<td>Days over 35°C</td>
<td>17</td>
<td>21-26</td>
<td>24-31</td>
<td>29-47</td>
</tr>
<tr>
<td>Days over 40°C</td>
<td>2</td>
<td>3-5</td>
<td>3-6</td>
<td>5-13</td>
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</tbody>
</table>

These are long-term averages, superimposed on large variability.

Less frost and snow, more heatwaves and fires.
Future changes in average rainfall

Annual rainfall in 2030
- South: 0 to -10%
- North: +5 to -10%

Largest decreases in winter and spring

Increased drought extent and frequency in the south

Median % rainfall change in 2030, relative to 1990, for a medium emissions scenario (stippling shows where at least 67% of models agree on the direction of change)
The future: adapting to what?

- Increased frequency/severity of heat waves
- Rising sea level
- More frequent/more prolonged droughts
- More intense storms
  - More intense rainfall events
  - Change in hail storm occurrence
Vulnerability hot spots

- **Kakadu**: Saltwater intrusion due to rising sea-level, displacement of freshwater wetlands by mangroves. Changed species assemblages.
- **Queensland Wet Tropics**: Multiple species extinctions predicted for upland endemic vertebrates for moderate levels of warming. Deterioration of coral reefs. Large losses to built environment from flooding, sea-level rise and cyclone storm surges.
- **South-western Australia**: Drying and water shortages. Range reductions and fragmentation for many endemic plants and crops.
- **Murray Darling Basin**: Reduced water supply for irrigation, cities, industry and environmental flows. Threats to freshwater wetlands such as the Macquarie Marshes. Reduced habitat for migratory birds.
- **Southeast Queensland**: Ongoing development is likely to be exacerbated by large losses to built environment from rising sea-level, storm surges and flooding.
- **Alpine Zones**: Loss of plant and animal species, increase in shrubs at expense of herb fields. Glacier shrinkage and reduction in snow cover. Threats to NZ built environment from increased flooding, erosion and landslides.
Potential impacts

- Water security problems are likely to intensify in southern and eastern Australia.
  - Around 9% less water in the northern Murray Darling Basin (MDB) by 2030, and 13% less in the southern MDB.

- Greater risks for coastal flooding from sea-level rise and storm surges.
  - Area inundated by a 1-in-100 year storm surge in Cairns is likely to double by 2050.

- Significant loss of biodiversity in sensitive areas.
  - By 2020, bleaching and damage to Great Barrier Reef equivalent to that in 1998 and 2002 in up to 50% years.
Potential impacts

Greater risks to major infrastructure due to increases in extreme weather events
More damage to buildings, transport services, energy services, telecommunications and water services

More heat-related deaths for people aged over 65
1115 deaths per year at present in the 5 largest capital cities, increasing to 2300-2500 per year by 2020

Reduced production in agriculture and forestry in south and east
National wheat yield: +10% to -50% by 2070
Reduced grape quality by 2030
Many impacts can be avoided, reduced or delayed by mitigation.
Many impacts can be avoided, reduced or delayed by mitigation.

<table>
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<th>Global mean annual temperature change relative to 1980-1999 (°C)</th>
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<tr>
<td>0</td>
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<td><strong>WATER</strong></td>
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<td><strong>ECOSYSTEMS</strong></td>
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<td><strong>FOOD</strong></td>
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<td><strong>COAST</strong></td>
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<td><strong>HEALTH</strong></td>
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<td><strong>SINGULAR EVENTS</strong></td>
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2100 impacts for unmitigated emissions
Many impacts can be avoided, reduced or delayed by mitigation

Costs at global, national or local level

- Costs of mitigation
- Costs of damage

Reduction in Atmospheric CO₂ ppm
EFFECTIVENESS OF ADAPTATION

Reduction in Atmospheric CO₂ ppm

Costs of mitigation

Costs at local, national, global or project level

COST

Low Adaptation

High Adaptation

DAMAGE

Costs of damage

Costs of adaptation

Reduction in Atmospheric CO₂ ppm

Costs at local, national, global or project level
Adaptation and mitigation

• Adaptation is essential
  – To deal with climate change already in the pipeline, and in the waiting period until mitigation activities start to take effect
  – To deal with future ‘inevitable’ climate change, beyond our ability to mitigate

• Adaptation alone is insufficient
  – Unmitigated climate change is beyond our ability to adapt
  – Therefore mitigation activities to stabilise climate change are essential
To conclude

• A portfolio of adaptation and mitigation measures is required

• If we believe that the threshold for ‘dangerous climate change’ is +2deg C over pre-industrial

• Then it is unlikely we can avoid dangerous climate change

• We need to take action to mitigate emissions

• And to adapt to inevitable climate change