Climate change impacts in Gippsland

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Overview

• Discussion of impacts:
  Water resources
  Agriculture
  Alpine areas
  Coastal zone
  Biodiversity

• Current thinking on adaptation to climate change

• Conclusion
Water resources

- Changes in supply, peak streamflow timing
- Increased irrigation demand, stress on major rivers
- Deterioration of water quality (sediment loads, eutrophication, salinity)
- Reduced environmental flows
- Complex changes to catchment hydrology
Water resources

• Major river basins:
  South Gippsland
  Latrobe
  Thomson-Macalister
  Mitchell
  Tambo
  Snowy
  East Gippsland

• CSIRO study on Victorian runoff: tendency for decreased runoff in all of the above basins with the possible exception of East Gippsland
South Gippsland

Rivers/Tributaries:
Bass, Powlett, Tarwin, Franklin, Agnes, Tarra.

Water storages:
Candowie and Lance creek reservoirs.

Mean annual runoff:
851 000 ML

Land use:
Dairying, crops, pigs, cattle, sheep
for wool, tourism

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<th>2030 wettest</th>
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Latrobe

Rivers/Tributaries:
Toorongo, Tanjil, Tyers, Moe, Morwell

Water storages:
Blue Rock lake, Yallourn, Hazelwood Pondage, Moondarra Reservoir

Mean annual runoff:
887 000 ML

Land use:
Agriculture, timber production, coal mining, energy generation

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Thomson-Macalister

Rivers/Tributaries: Thomson, Avon, Perry, Macalister

Major storages: Lake Glenmaggie, Thomson reservoir

Mean annual runoff: 841,600 ML

Land use: Dairying, mixed farming of beef cattle and sheep, vegetable growing

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Rivers/Tributaries: Wongungarra, Dargo, Wentworth

Mean annual runoff: 1 100 000 ML

Land use: dairying, grazing, grain production

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Mean annual runoff: 329 000 ML

Land use:
Cattle and sheep farming, horticulture, grain production

2030 wettest 2030 driest 2070 wettest 2070 driest
0% -30% 0% > -50%
**Mean annual runoff:**
863 000 ML (Victoria)

**Land use:**
Timber, horticulture, cattle and sheep grazing, hydroelectricity (in NSW)

**Rivers/Tributaries:**
Snowy, Suggan Buggan, Little, Murrindal, Buchan, Deddick, Rodger, Brodribb

**2030 wettest:** 0%
**2030 driest:** -30%
**2070 wettest:** 0%
**2070 driest:** > -50%
East Gippsland

Rivers/Tributaries:
Genoa, Batka, Wingan, Thurra, Cann, Bemm

Mean annual runoff:
655 000 ML

Land use:
Timber, beef cattle, conservation
Agriculture

• Key activities: horticulture, grazing (dairy, beef, lamb, wool), timber

• Increased CO$_2$: positive growth effects, but potential changes in quality will need to be monitored

• Higher temperatures: affect growth cycle of deciduous fruit; reduced uniformity at harvest

• Complex changes may lead to increased need for fertilizer, herbicides or pesticides

• Irrigation availability crucial
Agriculture

- Grazing: most of the variance in primary production in grassland systems is due to precipitation.
- Large reductions in rainfall will increase the variability of stocking rates.
- Vigour of pasture growth may increase, but forage quality may decline.
- Increased probability of heat stress in dairy cattle.
Agriculture

• Forests: Climate change could affect a hierarchy of interacting issues such as changes in landscape hydrology, fire regimes, pests, and vegetation composition

• Native forests are often located on sites where growth is limited by nutrients and water, so their response to higher CO$_2$ is uncertain
Agriculture

Land suitability analysis CSIRO/ Vic NRE

- Cool climate grapes:
  More high-suitability areas in the west of Gippsland under both moderate and extreme scenarios

- Perennial Rye Grass and White Sub-clover pasture:
  Changes minor in the short term, but possibility of a significant decrease in land suitability by 2050

- Blue gum plantations:
  Climate scenarios have little effect on land suitability
Alpine areas

- Key areas for conservation, tourism
- Already ecological changes
- CSIRO/ANU study
  Decreased snow cover (60+ days):
  18-60% by 2020, 38-96% by 2050

Reduced season length:
5 days by 2020, 15-20 days by 2050 (low)
30-40 days by 2020, 100 days by 2050 (high)
Snow depth
2020: maximum occurs earlier in the season 2050: low impact scenario shows reduction in peak depths of over 80% at lower elevation sites such as Mt. Baw Baw

Adaptation possible in the short term
Coastal zone

- Sea level rise, flood risk: 3 to 17cm by 2030 and 7 to 55cm by 2070
- Impacts on fisheries and marine biodiversity largely unknown, possible extinctions with 1-2°C
- Wind speeds: greatest increases in winter, decreases in mean and extreme winds in autumn
- Storm surge height +6% in 2030, +19% in 2070 (worst case). Possible delayed onset of storms until period between winter and early summer
Biodiversity

• Bioregions:
  
  Victorian Alps
  Highlands- Southern Fall
  Highlands-Northern Fall
  Gippsland Plain
  Wilson’s Promontory
  East Gippsland Uplands
  East Gippsland Lowlands

• These bioregions cover a climatic gradient from high altitudes to the coast
Biodiversity

• Limited research: lack of baseline data, complexity

• 819 eucalypt species (Hughes et al. (1996))
  25% have climatic ranges that span less than 1°C

• 42 Victorian fauna species (Brereton et al. (1995))
  79% of bioclimates contract with 1°C warming

• Species will not necessarily track moving climate zones across landscapes

• Refuges are highly vulnerable; species with a small distribution range are susceptible to minor temperature changes
Biodiversity

Indirect effects:
• Changed habitat or food supply, e.g. migratory birds
• Changed bushfire regimes, e.g. Eastern bristlebird, Smoky mouse
• Sedimentation, inappropriate flow regimes
• Fragmentation
• Invasive species, e.g. Paperbark sawfly
Adaptation

A socially-mediated process rather than a result

Core questions, ‘sustainability science’:

• The determinants of vulnerability and resilience
• Scientifically meaningful limits or critical thresholds
• How to enhance adaptive capacity
• How to integrate research, planning, monitoring and decision support into systems for adaptive management
Adaptation

• Risk-based approach:
  Accepts uncertainty, focuses on the probability of exceeding one or more criteria of vulnerability

• Focus on institutions and social capital:
  The norms and networks that allow people to act collectively, the ‘glue’ for adaptive capacity
Adaptation

• Adaptive management and learning by doing:
  Developing an optimal management capacity; process-oriented view of management involving social learning

• A new role for science:
  Interdisciplinary science and science-policy bridge building; integration of scientific expertise and local knowledge through collective discussion
Conclusion

• Impact studies have been undertaken on an ad-hoc basis, so just because nothing is known about a particular area doesn’t mean it isn’t important

• This project:
  A chance to take a strategic overview of regional, or local, priorities

• Aim:
  Go beyond just discussing climate change, generate feedback in order to discover information gaps, pathways for ongoing monitoring and adaptive management