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ADAPTING FARMING TO CLIMATE CHANGE IN THE ASIA-PACIFIC REGION

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**All the papers and presentations prepared for the
2008 IFA Crossroads Asia-Pacific in Melbourne will be
compiled on a cd-rom to be released in December 2008.**

www.csiro.au

Adapting farming to climate change in the Asia-Pacific region

Mark Howden, Rohan Nelson, Steve Crimp, Sarah Park and many other colleagues

Presentation to IFA Crossroads Conference, December 2008, Copyright CSIRO

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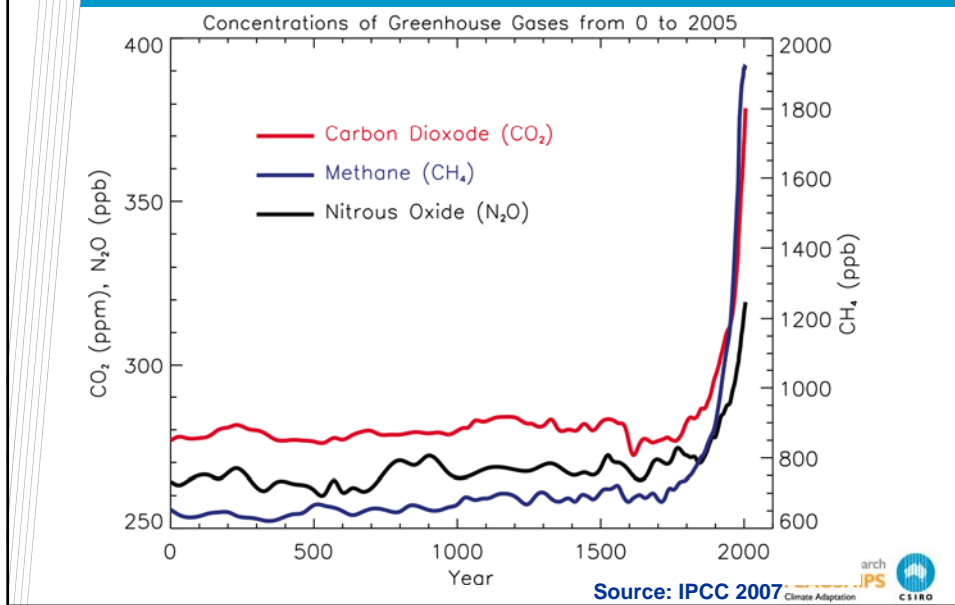
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Outline

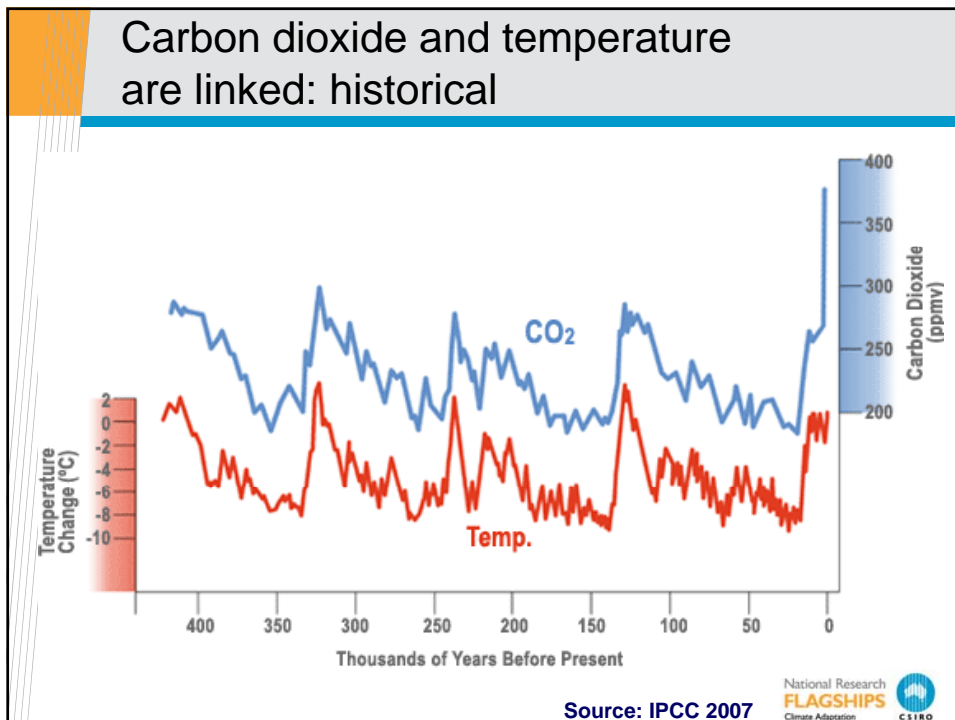
- Climate changes are already happening
- Future climate and other changes
- Some impacts and adaptations
- Some reflections on what this might mean for your industry
- Will focus on climate changes and impacts/adaptations but greenhouse emissions are also important

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Carbon dioxide and other greenhouse gases keep rising

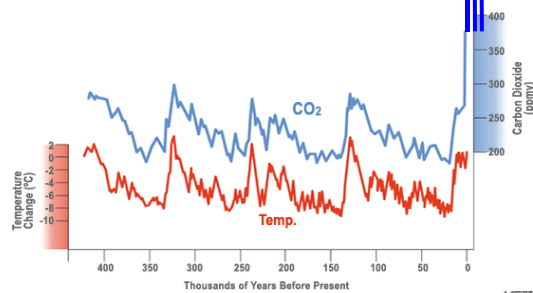


Carbon dioxide and temperature are linked: historical



Carbon dioxide and temperature are linked: future scenarios

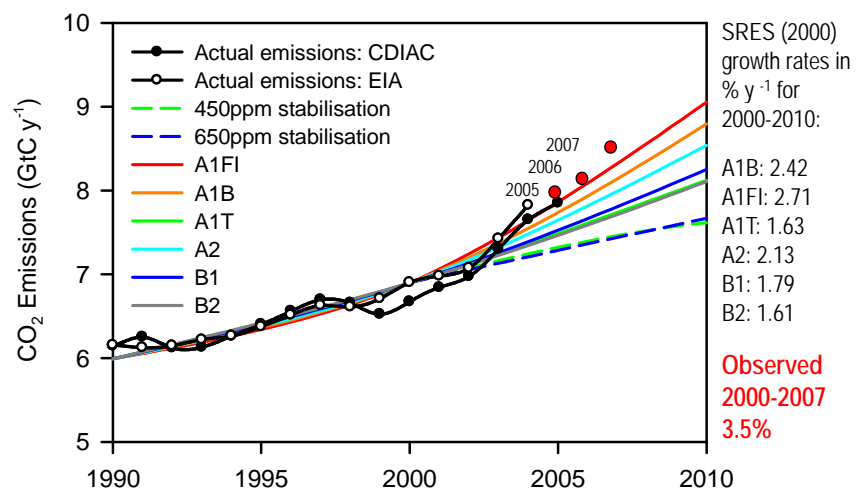
Between 520 to 1000 ppmv by 2100 with a mid-range of ~700ppm



Source: IPCC 2007

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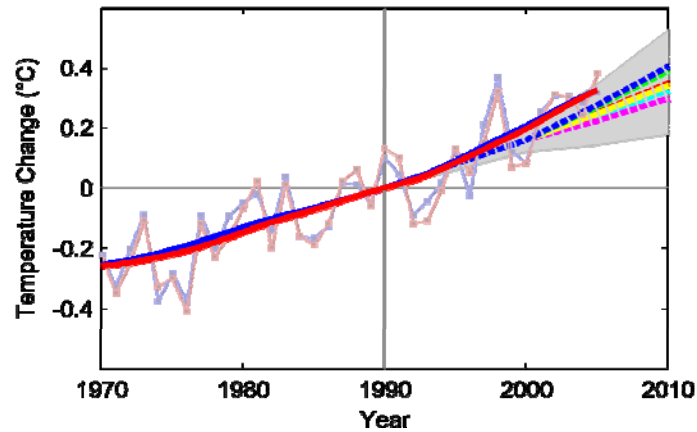
CO₂ emissions exceed all SRES (2000) scenarios



Raupach et al., Canadell et al (2007)

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How well is temperature tracking the IPCC projections?



Temperature rise near upper limit of the projections

Rahmstorf et al. (2007)

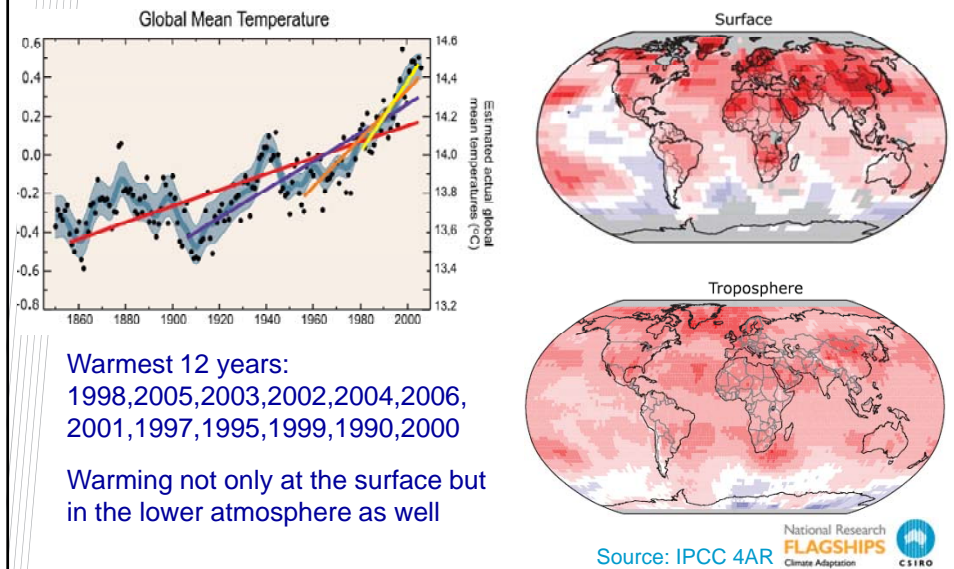
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IPCC Fourth Assessment Report excerpts

- Warming of the climate system is unequivocal
- Most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to increasing anthropogenic greenhouse gas concentrations
- Discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns
- Many studies show changes already happening in physical systems and biological systems
- Projected temperatures for the year 2100 range from 1.1 to 6.4°C
- Past greenhouse emissions have already committed the globe to further warming

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Instrumental observations of global warming



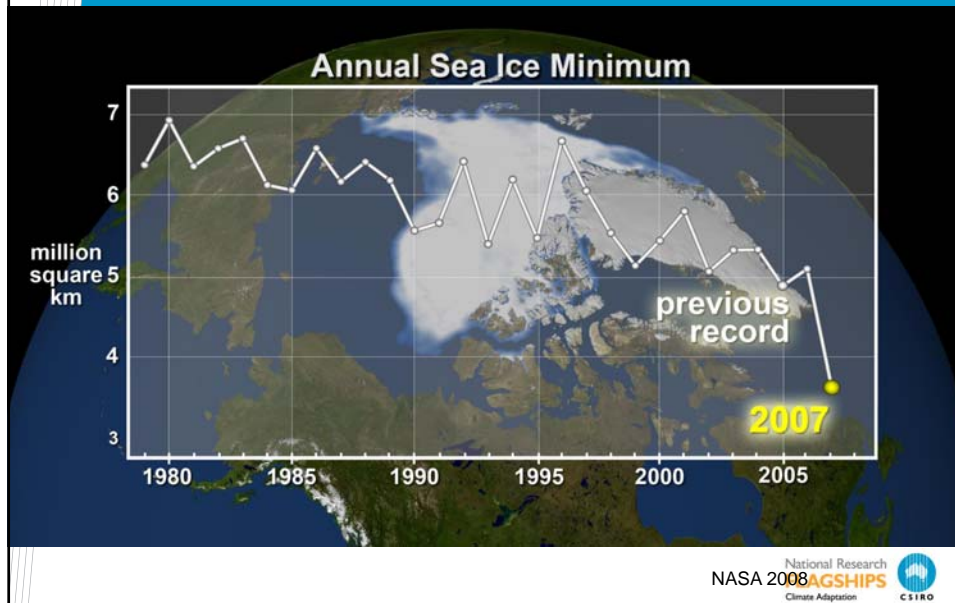
Warmest 12 years:
1998,2005,2003,2002,2004,2006,
2001,1997,1995,1999,1990,2000

Warming not only at the surface but
in the lower atmosphere as well

IPCC Fourth Assessment Report excerpts

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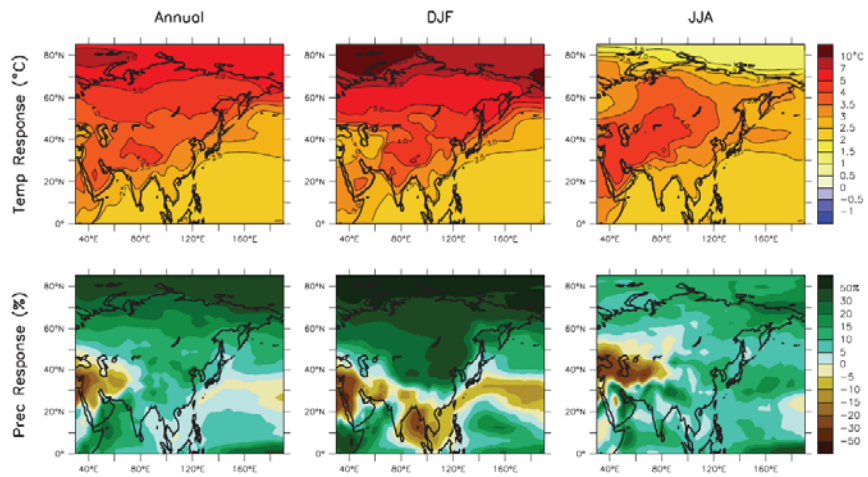
Arctic sea ice cover



IPCC Fourth Assessment Report excerpts

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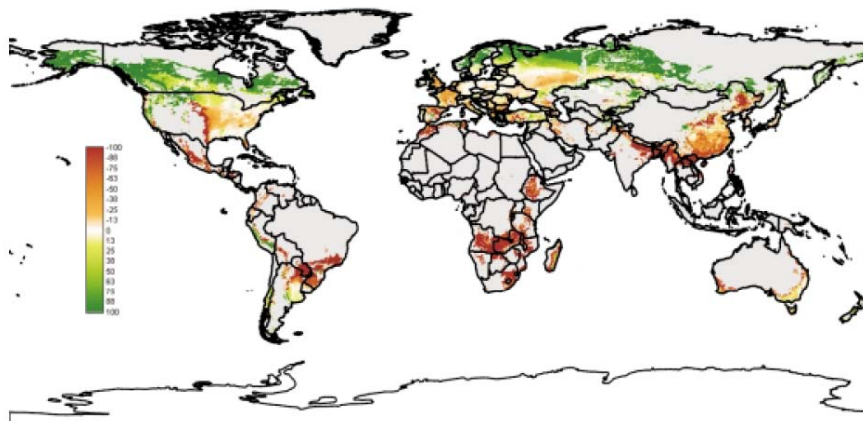
Climate change - Asia



Note that these are average changes, not top of the range

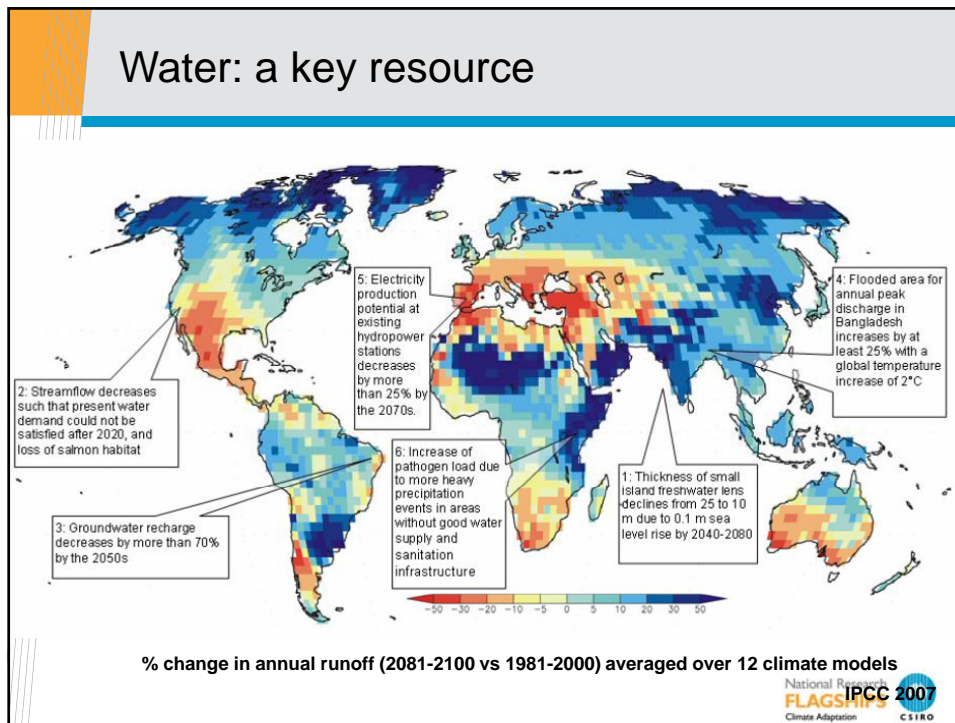
IPCC WGI (2007) National Research FLAGSHIPS Climate Adaptation CSIRO

Change in land suitability for rainfed crops



Fischer et al. (2005) National Research FLAGSHIPS Climate Adaptation CSIRO

Water: a key resource

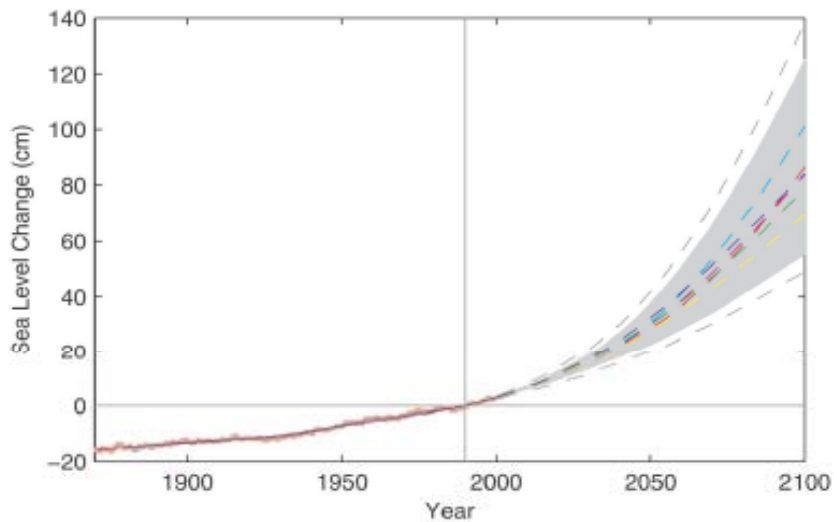


Water consumption may increase

- But increased potential evaporation due to warmer conditions is likely to increase water demand



Sea level rises



Rahmstorf, 2006

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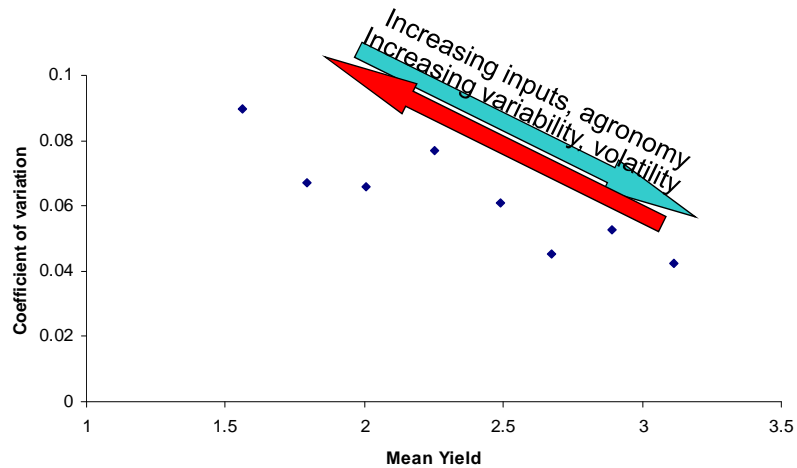
Cyclones and El Niño

- Increased intensity seems likely but uncertainty as to change in frequency or distribution
- Strong dependency of cyclone strength and distribution on El Niño is likely to continue but ...
- The climate models do not give a consistent indication of future changes in El Niño events
- However it is likely that global warming will enhance the dry conditions associated with warm phase (El Niño) events, and enhance intense rainfall and run-off associated with cool phase (La Niña) events

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Yield and variability: global



Cyclones/tempests/hurricanes,
storms, floods, droughts, El Niño

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Many adaptations are possible

- Varieties, species, planting times
- Nutrient management and rotations
- Residue management
- Water management
- Seasonal climate forecasting
- Tools/training
- Regional development and trade policies
- Etc etc

An overview of the adaptive capacity of the Australian agricultural sector to climate change – options, costs and benefits

Mark Howden, Andrew Ash, Snow Barlow, Trevor Booth, Stephen Charles, Bob Cechet, Steven Crimp, Roger Gifford, Kevin Hennessy, Roger Jones, Miko Kirschbaum, Greg McKeon, Holger Meinke, Sarah Park, Bob Sutherst, Leanne Webb, Peter Whetton.

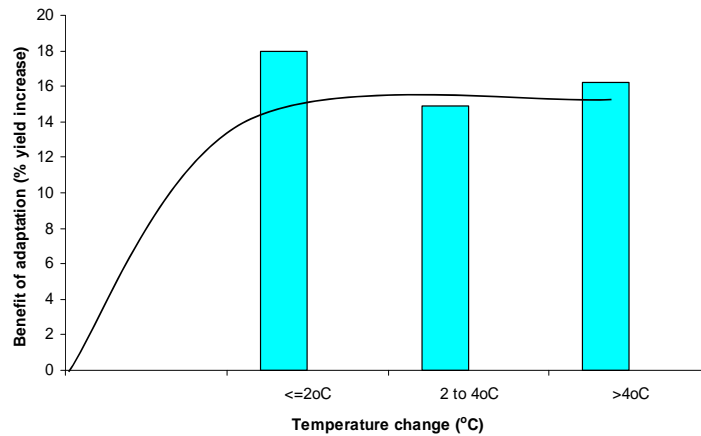


Sustainable Ecosystems

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Are adaptations likely to be worthwhile ?



Howden et al. (2007)

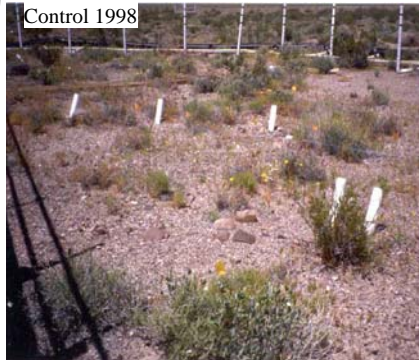
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Crop quality and nutrient demand

- Elevated CO₂ concentrations mean that crops can grow bigger on the same amount of water and sunlight (about 16% more by year 2050)
- But at the expense of lower grain and forage quality
- Furthermore, inadequate nutrition results in the benefits of CO₂ not being expressed
- Consequently, one adaptation is increasing effective application of fertilisers (all else being equal)

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CO₂ increases will affect crop growth



Ambient ~360ppm CO₂



550ppm CO₂

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Conclusions

- Our climate is changing already – increasing human influence
- More change seems to be in store
- Climate change is likely to impact on what agriculture occurs, where, how productive it is and what inputs it needs
- Large range of adaptations which can help adjust to anticipated climate changes
- Some of these adaptations relate to improved crop nutrition – increasing the need for best practice use of fertilisers

Climate Adaptation Flagship

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