



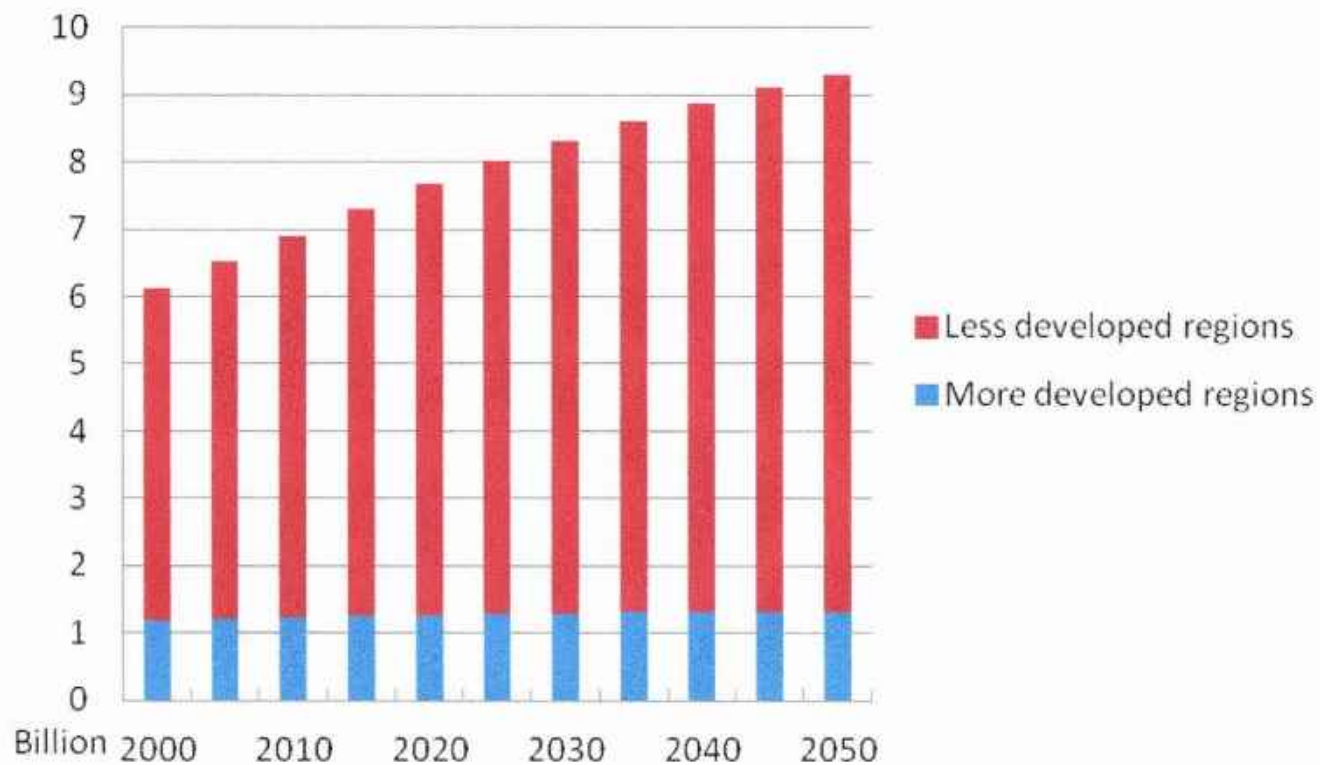
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Population Growth to 2050

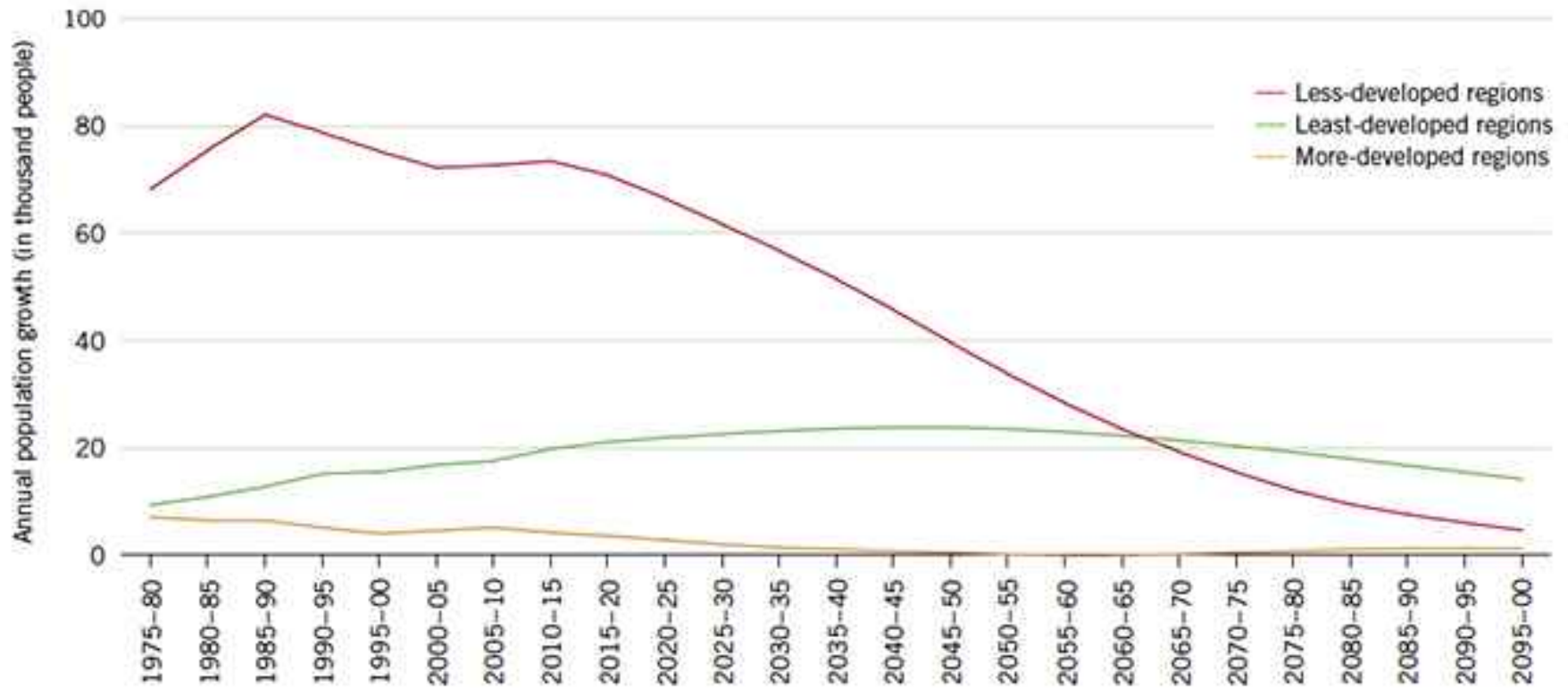
Figure 1 United Nations population estimates



Data source: United Nations (2011a)

Population Growth to 2050

FIGURE 3.4 PAST AND PROJECTED POPULATION GROWTH, 1975-2100



Food Security Challenge

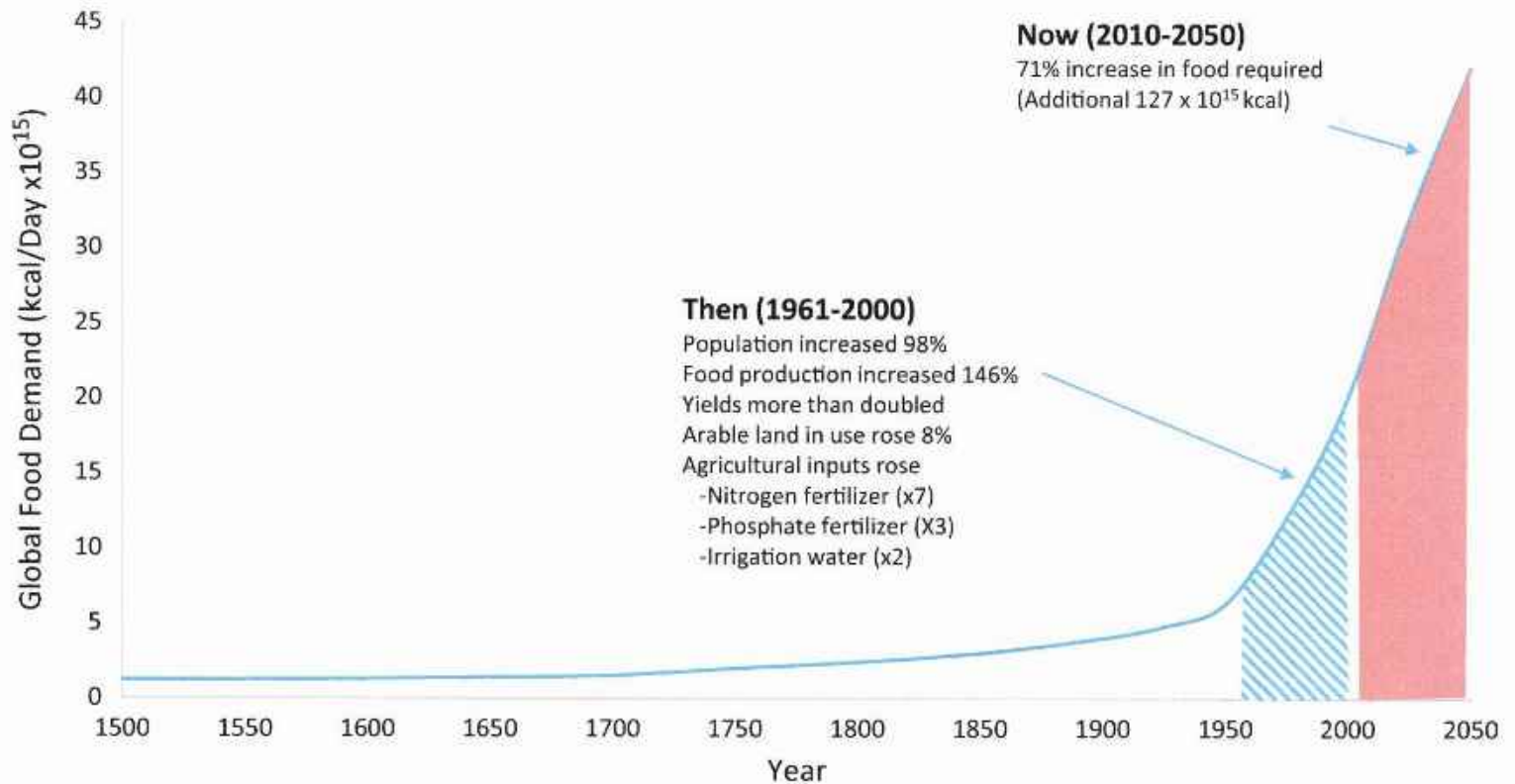
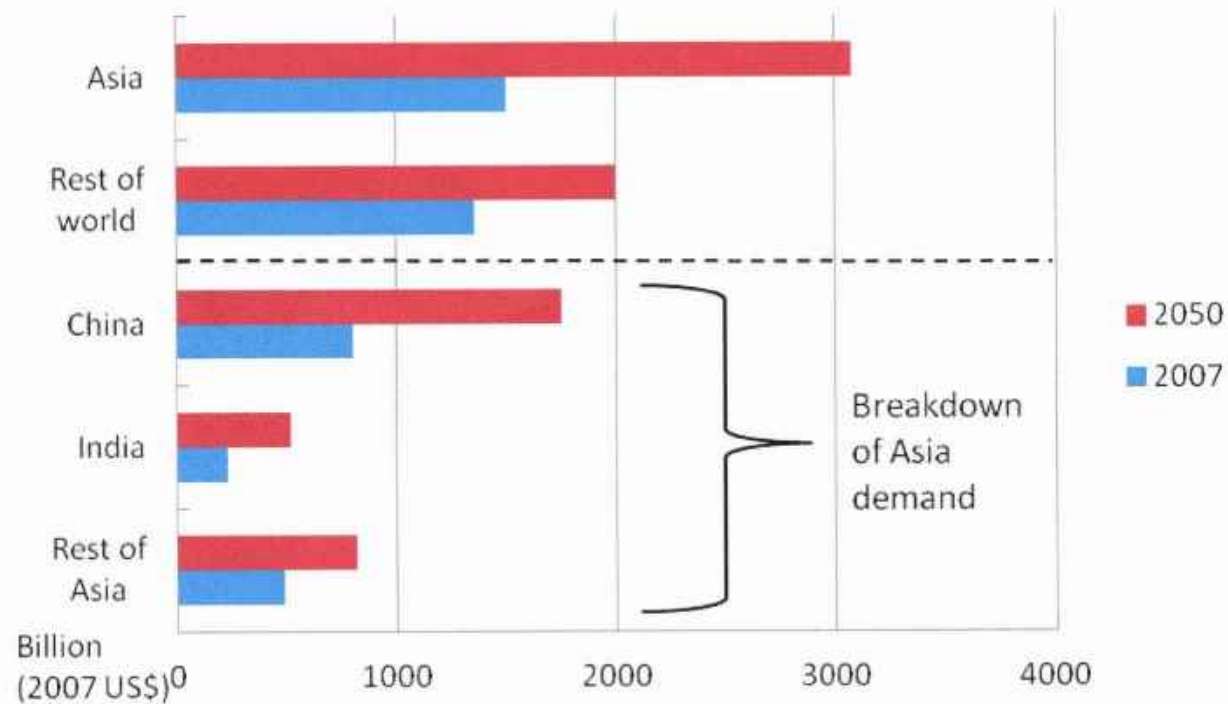


Fig. 1 Framing the food security challenge (adapted from Keating et al. 2014; Keating and Carberry, 2010)^{2,3}

Food Demand 2050

Figure 3 World agrifood demand by region



Data source: ABARES model output

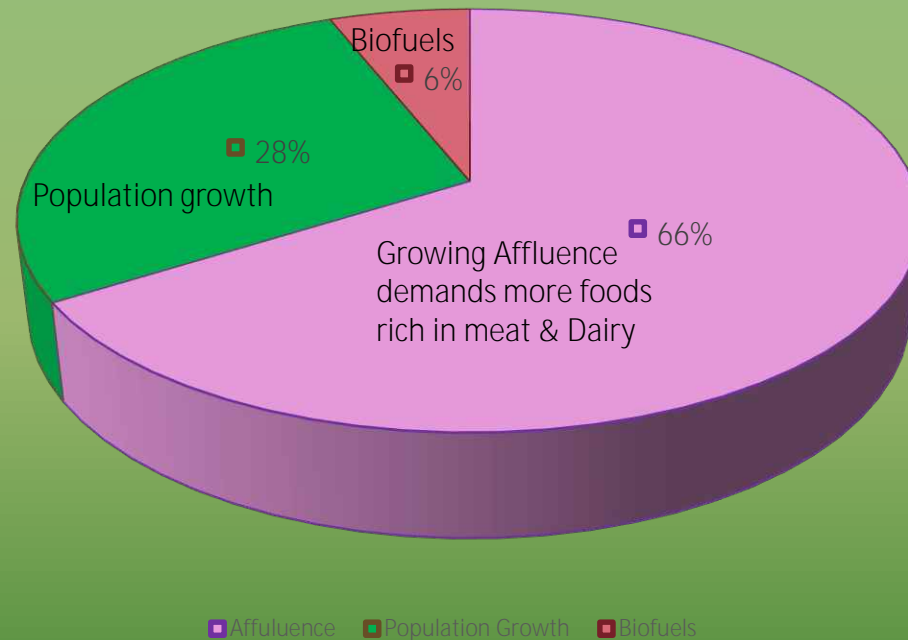
The Problem*

- > 9 billion people in 2050
- > 1 billion currently lack sufficient food
- > 1 billion currently hungry plus 2 billion+ additional people by 2050 - crop production will need to increase between 60 and 100 percent!
- “Business as usual” could lead to a doubling of demand for agricultural production.
- Question? - If the population is growing by less than one-third, why would the overall demand double?
- Answer:
 - more people with more money.
 - Increased production **alone won't** be enough
 - 9 percent of global crops are currently used to produce biofuels or other industrial products.

*Nikos Alexandratos, N. & Bruinsma J. - Global Perspective Studies Team FAO Agricultural Development Economics Division “*World agriculture towards 2030/2050: the 2012 revision*” in University of Minnesota “Food Matters.”

Pingali, Prabhu. (2007) Westernisation of Asian Diets and the Transformation of Food Systems: Implications for Research and Policy. *Food Policy* 32 (3): 281–98. in University of Minnesota “Food Matters.”

Contributors to 2050 Food demand

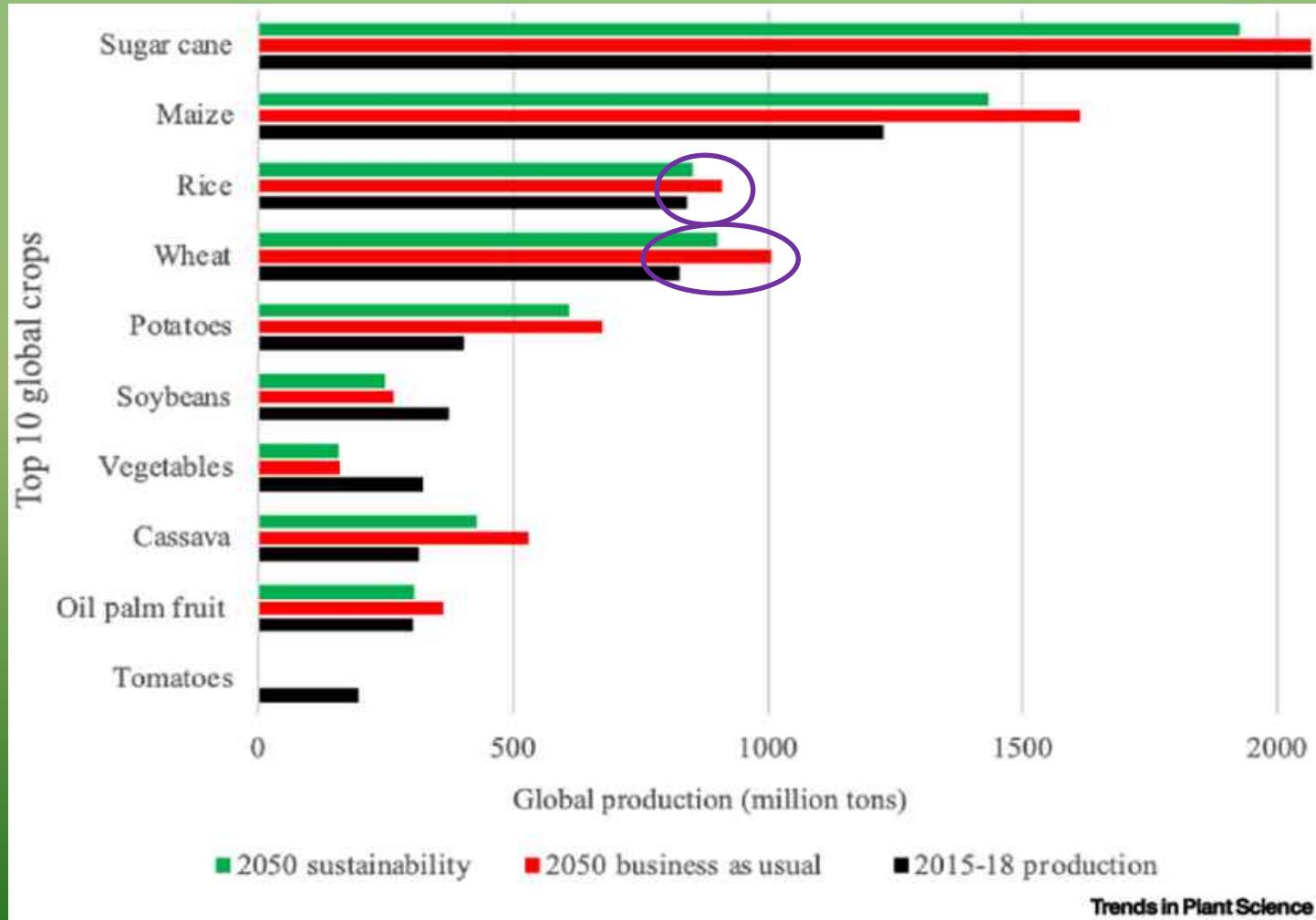


Sources:

Nikos Alexandratos, N. & Bruinsma J. - Global Perspective Studies Team FAO Agricultural Development Economics Division *"World agriculture towards 2030/2050: the 2012 revision"* in University of Minnesota *"Food Matters"*

Pingali, Prabhu. (2007) Westernisation of Asian Diets and the Transformation of Food Systems: Implications for Research and Policy. *Food Policy* 32 (3): 281-98. in University of Minnesota *"Food Matters"*

FAO Crop Predictions 2050



Annual Growth in Cereal Yields

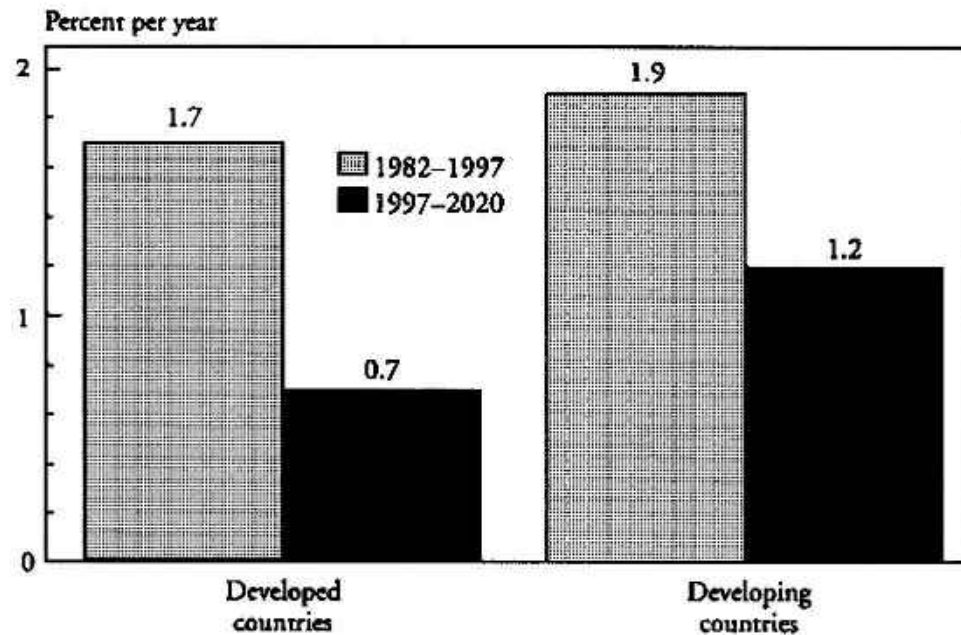
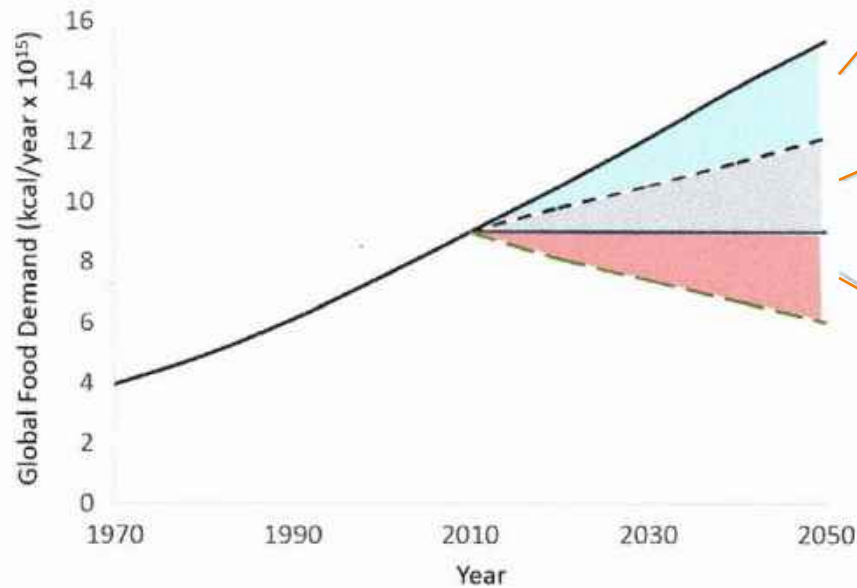


Figure 2.8 Annual Growth in Cereal Yields, 1982-2020

Source: IFPRI IMPACT simulations, October 2000.

The Solution?



Reduce demand

- Lower **consumption**
- Less **waste**
- Reduced **livestock** use
- Reduced **fuel from food**

Increase production

- More **Land**
- More **aquaculture**
- Improved **genetics**
- Greater **mechanisation and intensification**

Maintain current levels

- no increase in current **pest and disease resistance**
- Maintain **biosecurity**
- Avoid **soil and water degradation**
- Minimise **climate change**
- Adaptation** to inevitable climate change

Where Will The Production Growth Come From?

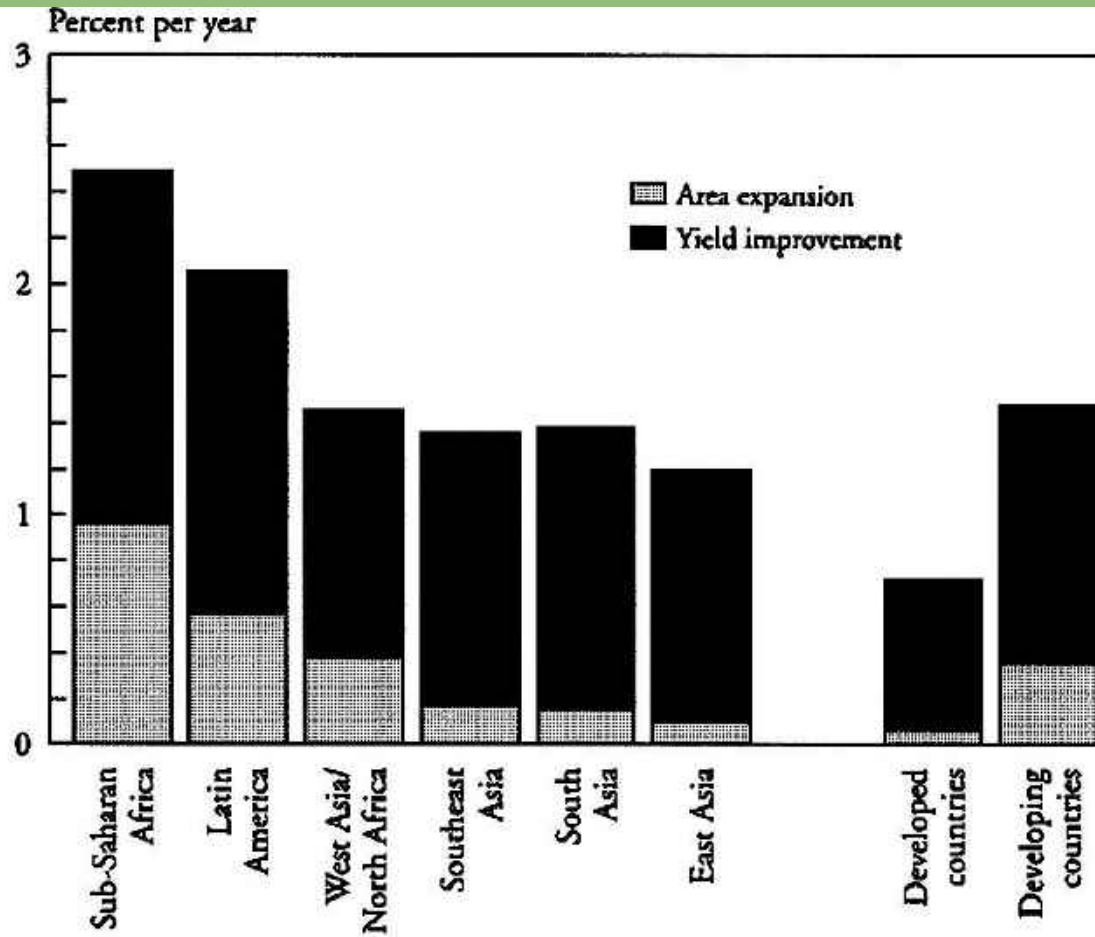


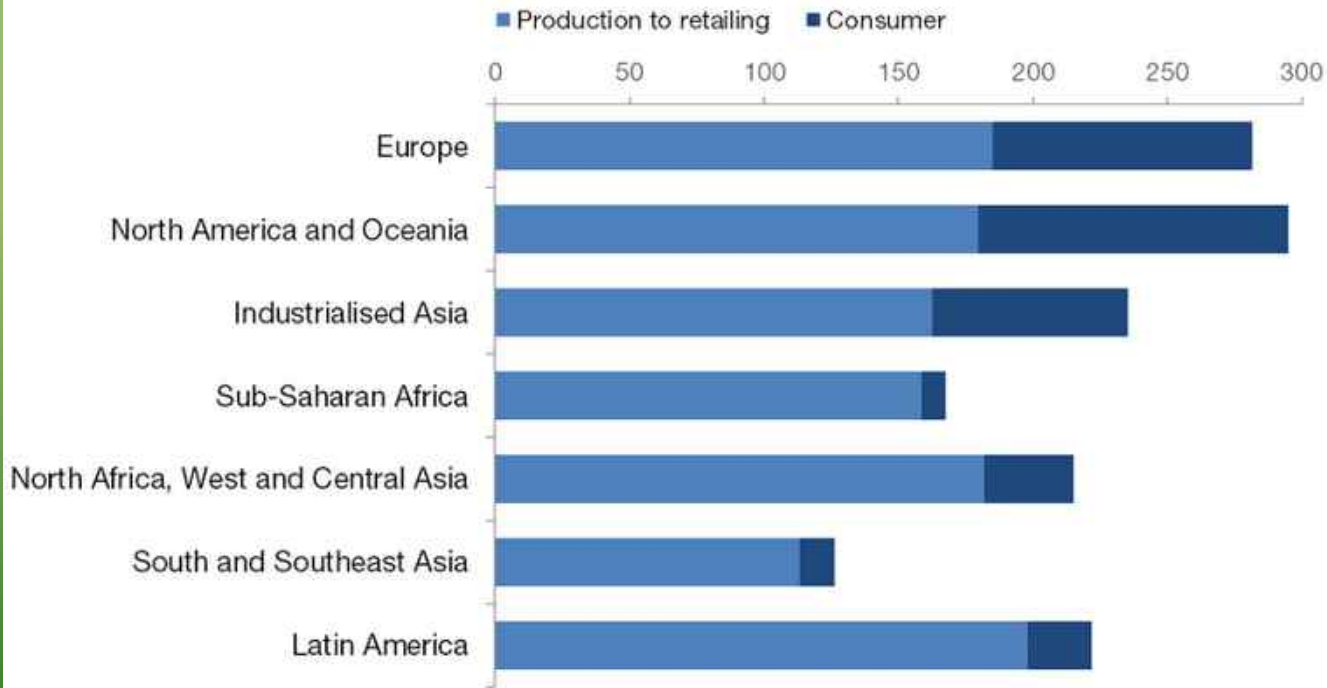
Figure 2.7 Sources of Growth in Cereal Production, 1997-2020

Source: IFPRI IMPACT simulations, October 2000.

Food wastage

Which regions waste the most food?

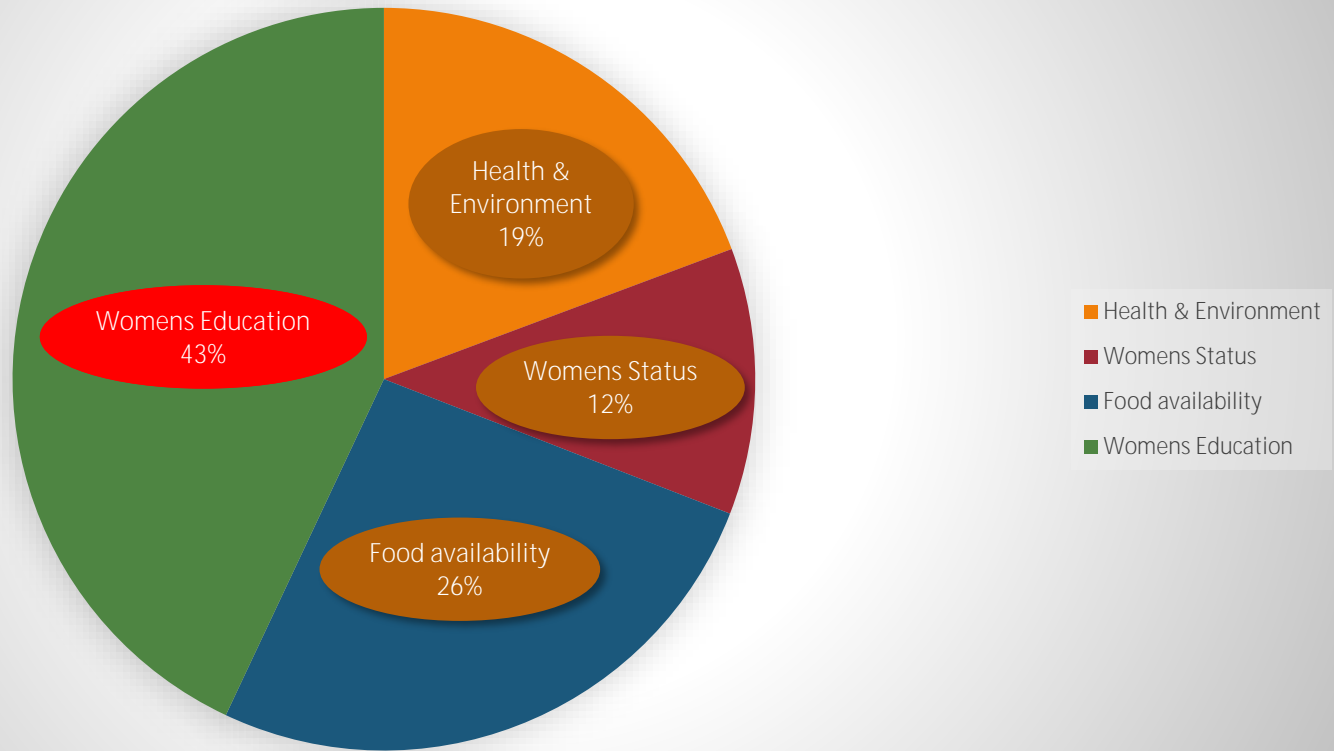
Per capita food losses and waste, kg/year



Source: The Food and Agriculture Organization of the United Nations (FAO)

Reducing Childhood Malnutrition

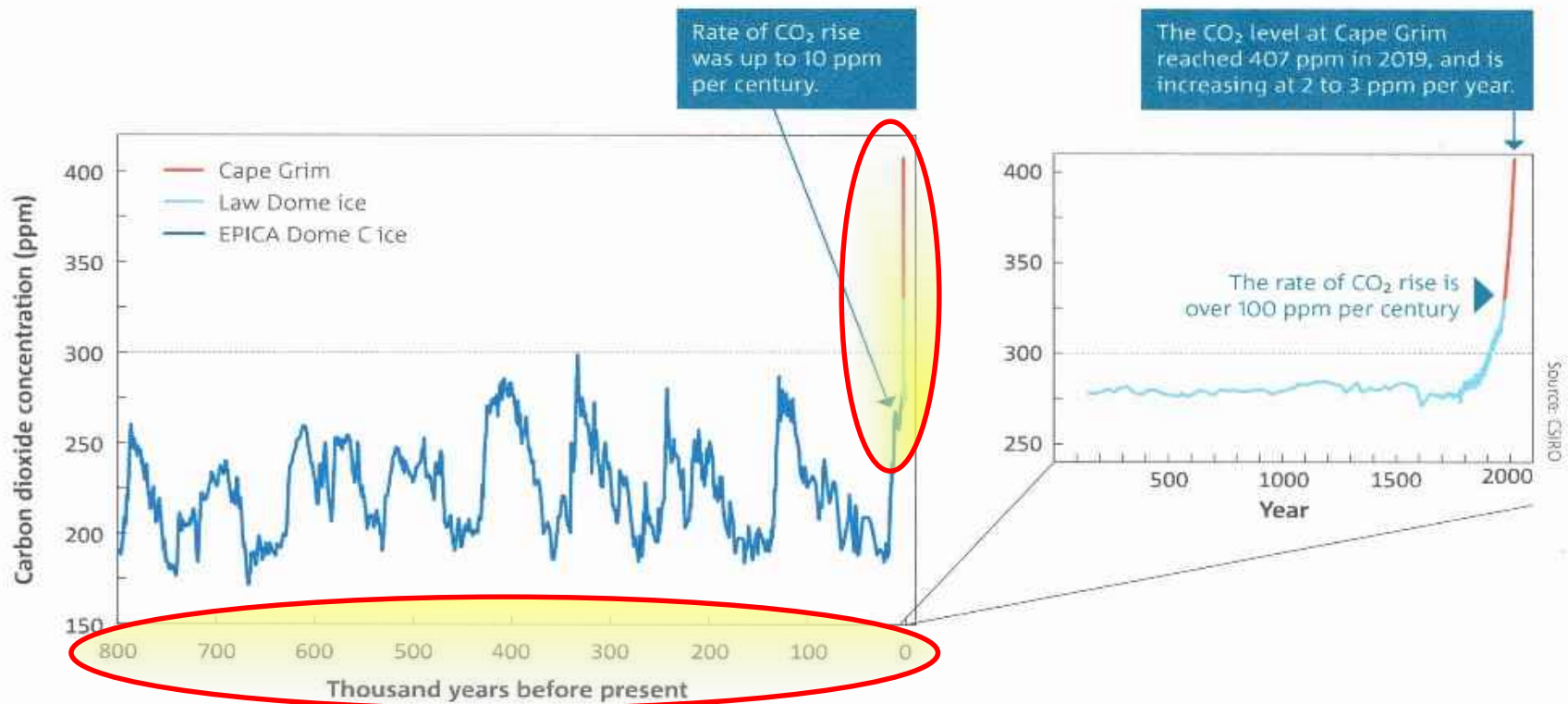
Reducing Childhood Malnutrition (2020)



Estimated Contribution of Major Determinants to Reductions in Child Malnutrition, 1970-95

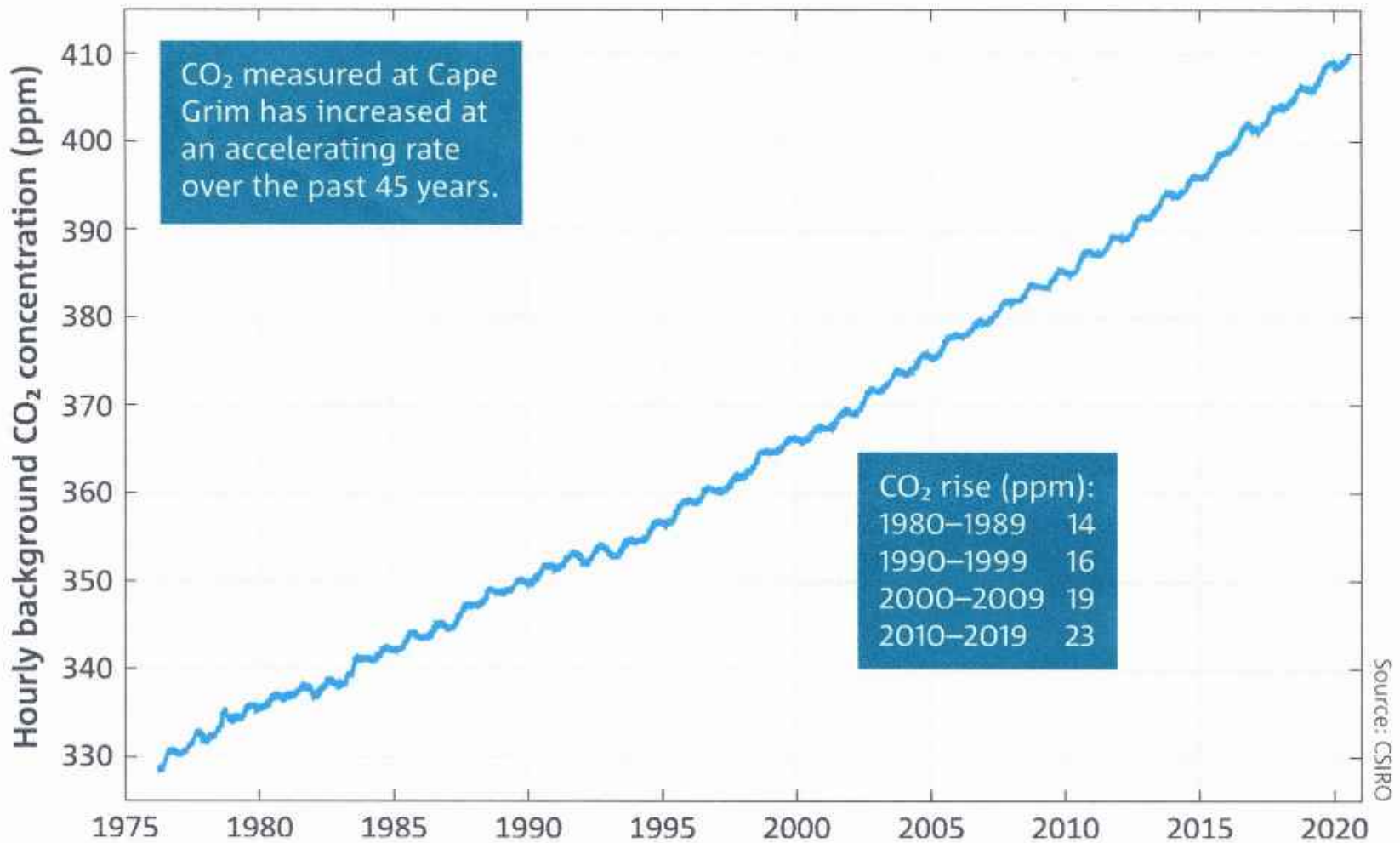
Source: Lisa Smith and Lawrence Haddad, "Overcoming Child Malnutrition in Developing Countries: Past Achievements and Future Choices", 2020 Vision Discussion Paper 30 (Washington, D.C.: International Food Policy Research Institute, 2000).

Historical CO₂ Levels

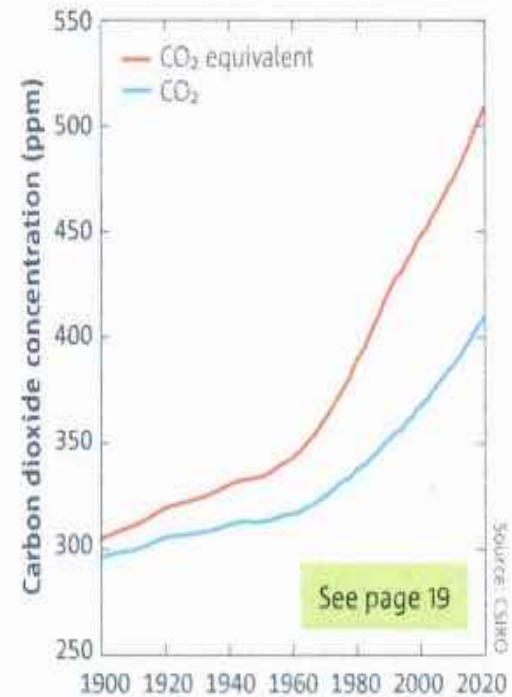
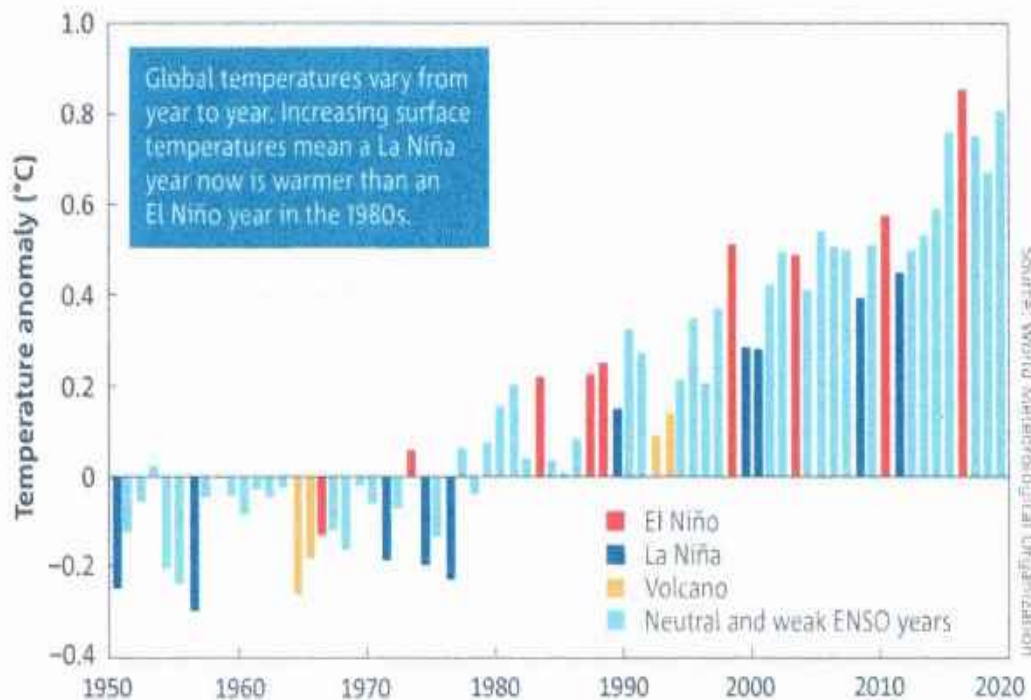


Atmospheric CO₂ concentrations, for the past 800,000 years (left), and for the past 2000 years (right). The time series, and information in the text boxes, are from measurements of air in Antarctic ice cores and at Cape Grim. Though there has been variability in the past, the rate of growth of CO₂ over the past century far exceeds (by a factor of 10 or more) the rate during the most rapid natural changes in the past (which occurred during de-glaciations).

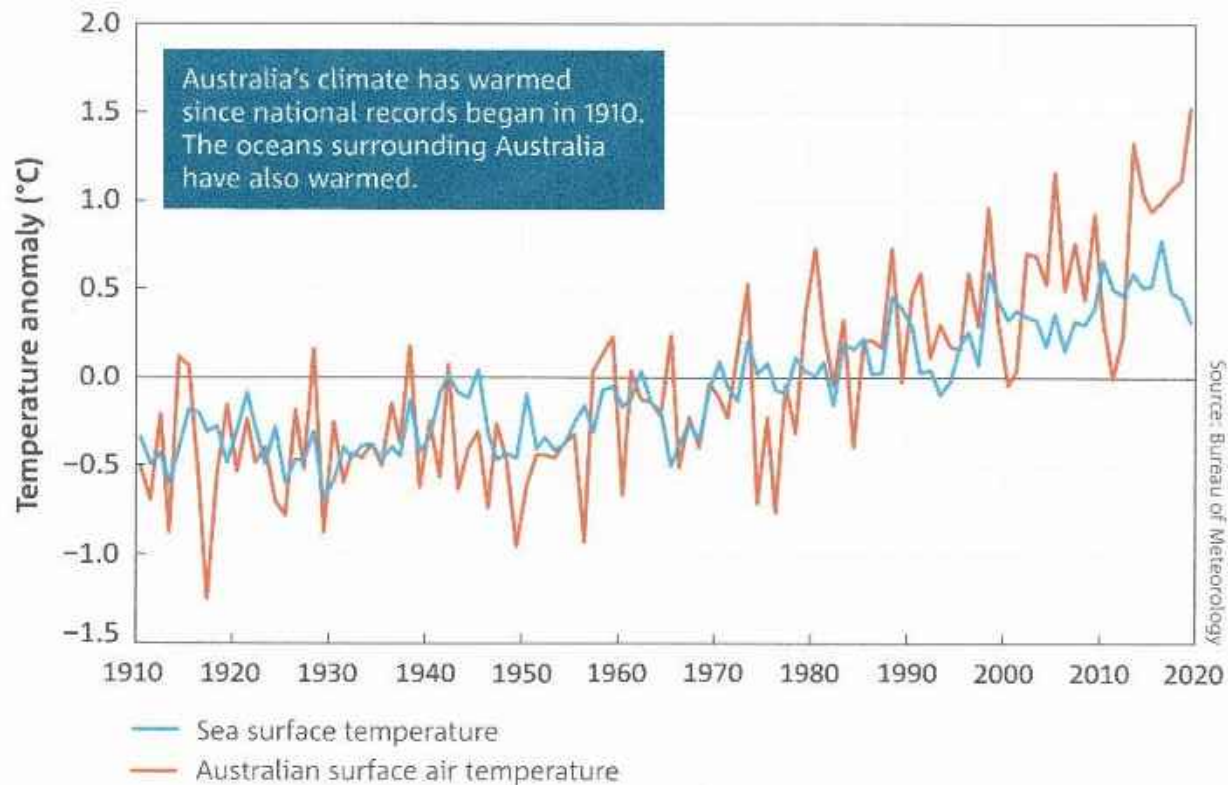
CO₂ levels since 1975



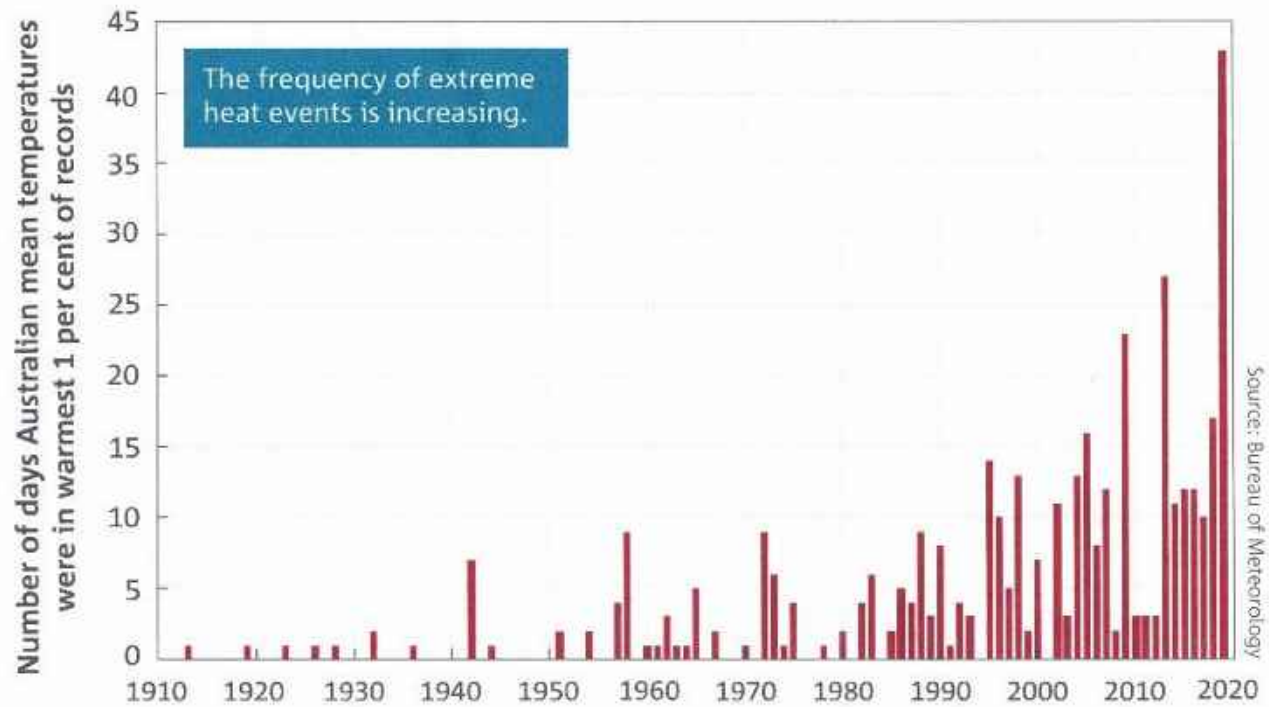
Global Temperature Changes



Australian Temperatures

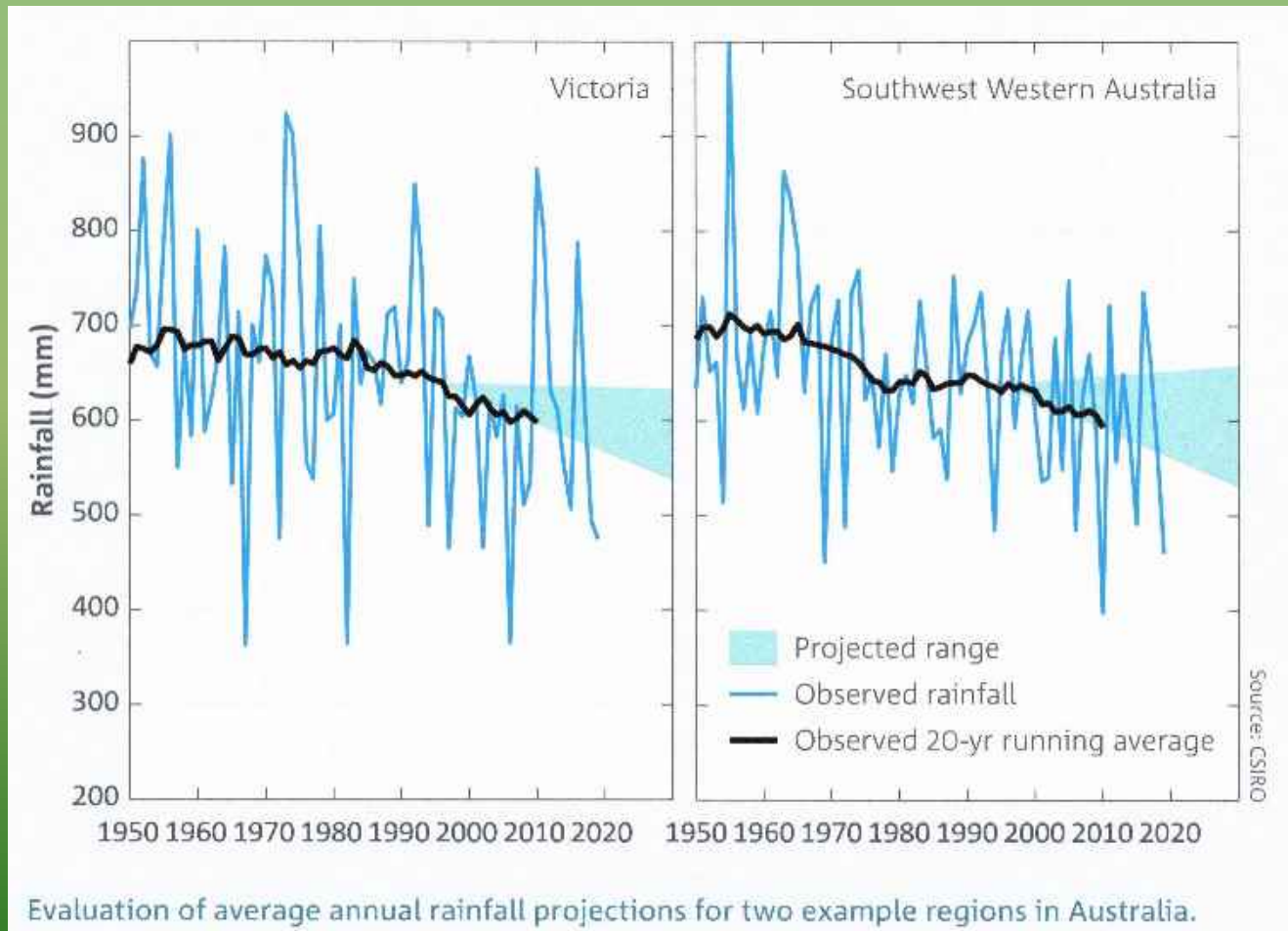


Extreme Heat Days/year



Number of days each year where the Australian area-averaged daily mean temperature for each month is extreme. Extreme daily mean temperatures are the warmest 1 per cent of days for each month, calculated for the period from 1910 to 2019.

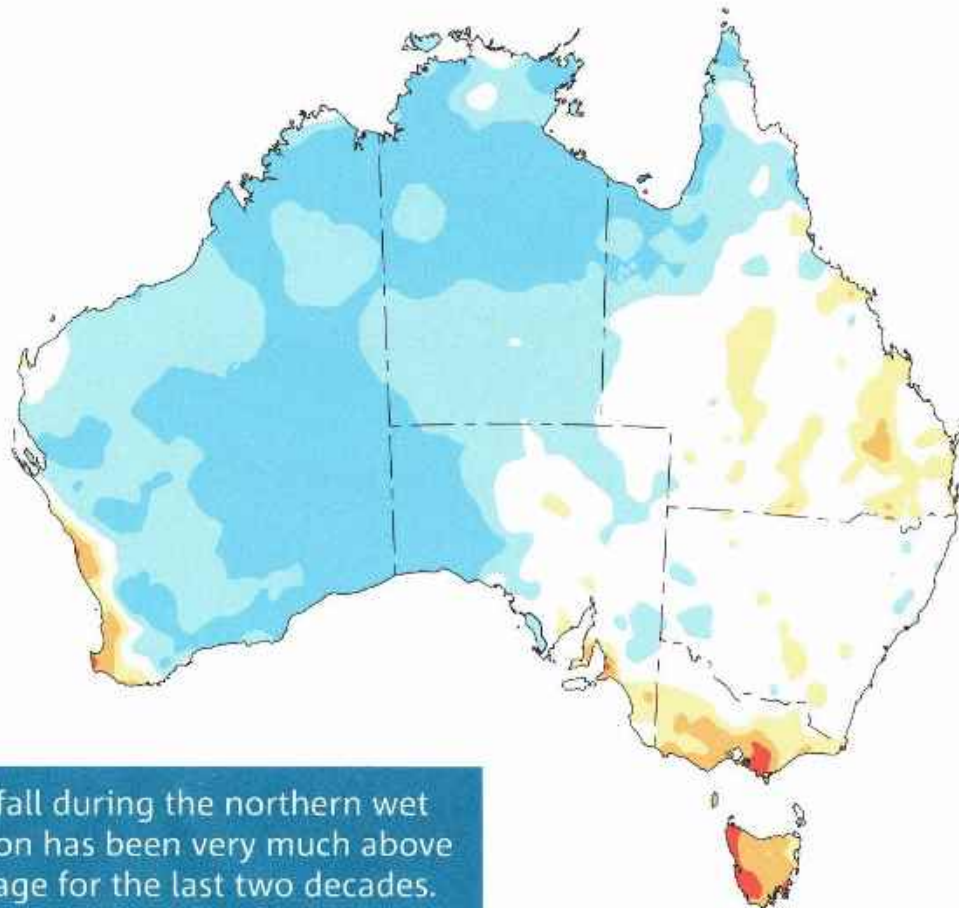
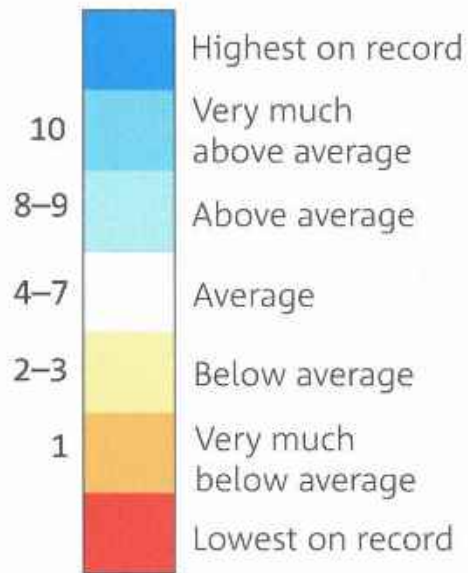
Rainfall 1950-2020



Evaluation of average annual rainfall projections for two example regions in Australia.

Rainfall – Northern Australia

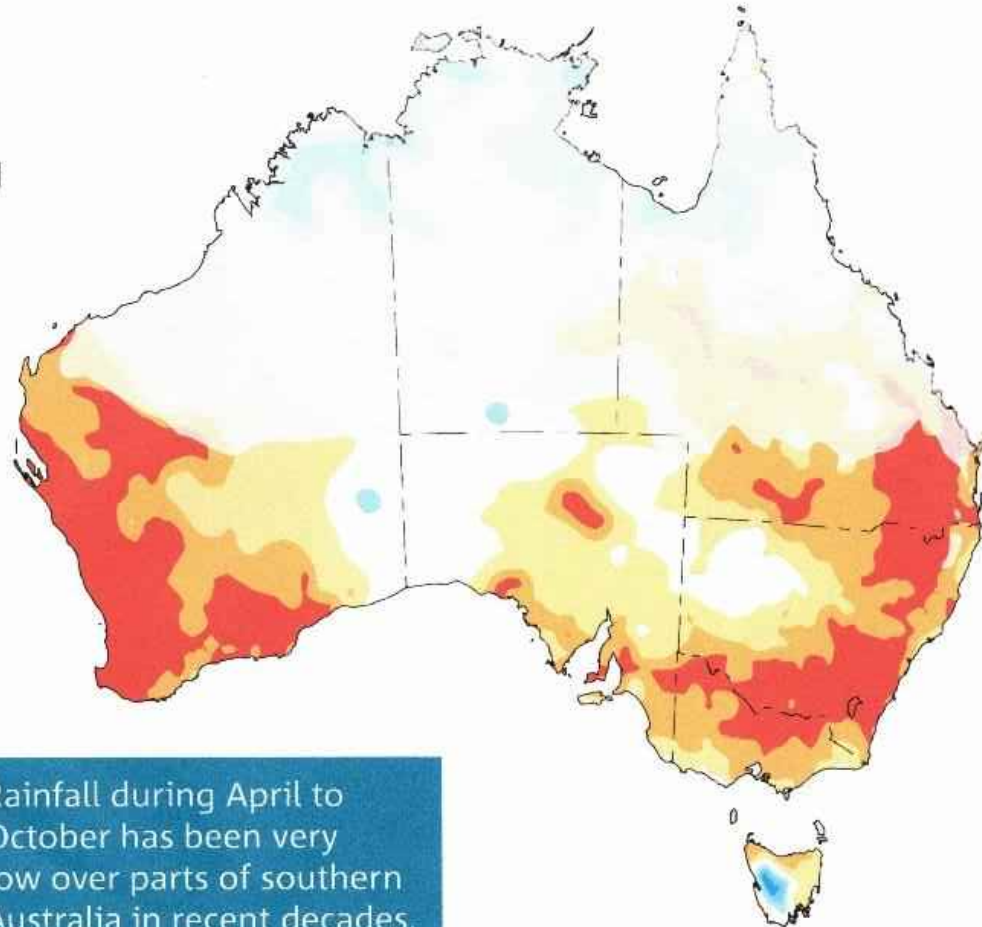
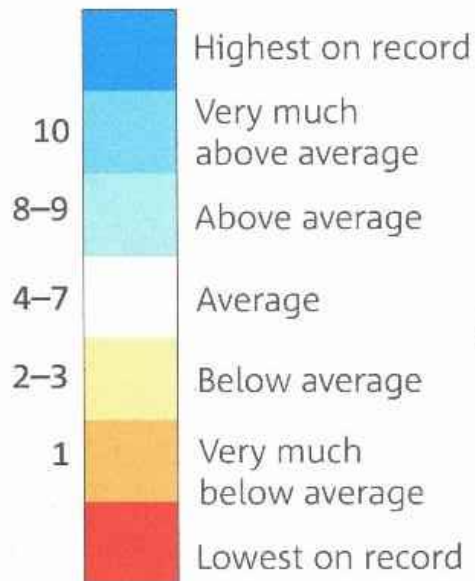
Rainfall decile ranges



Rainfall during the northern wet season has been very much above average for the last two decades.

Rainfall – Southern Australia

Rainfall decile ranges

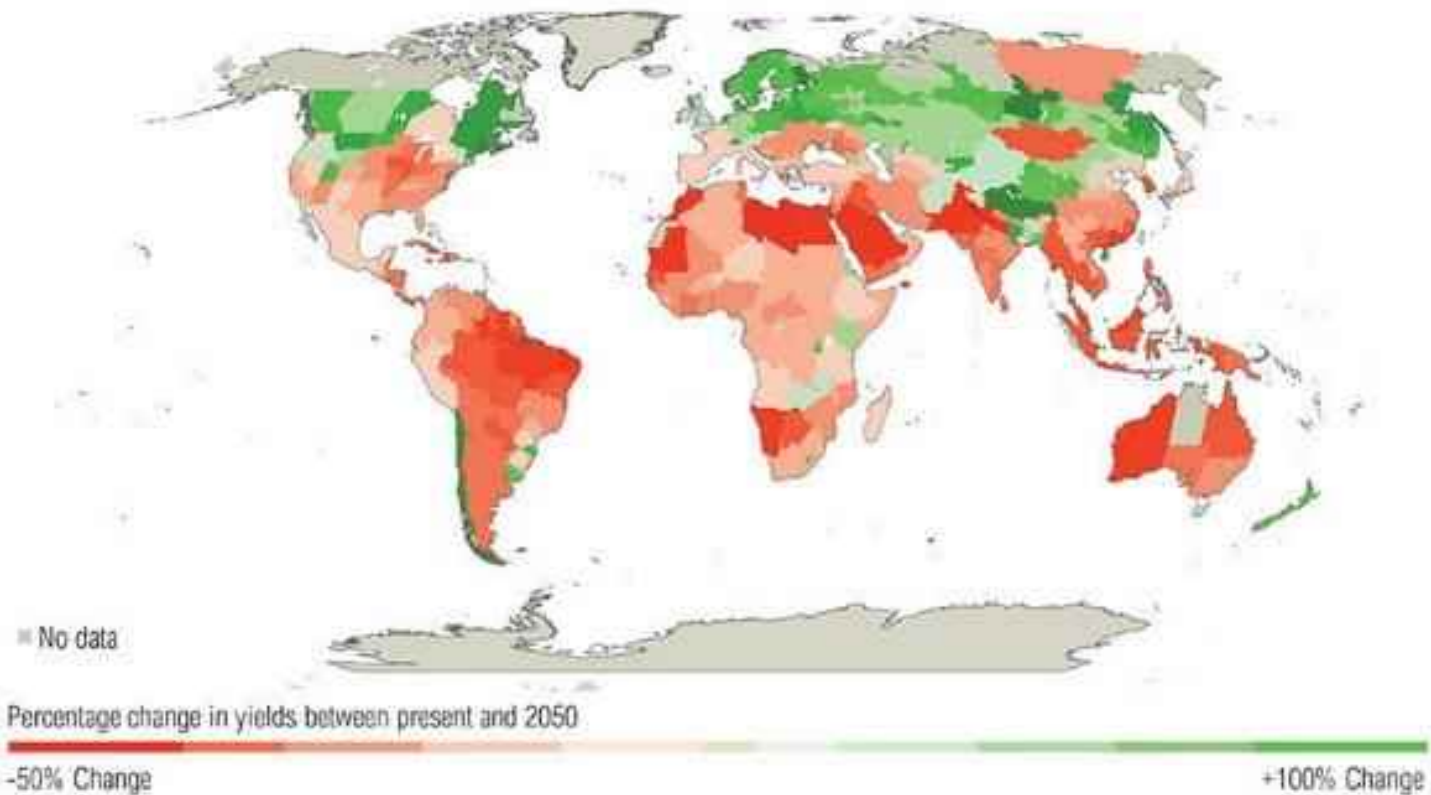


Rainfall during April to October has been very low over parts of southern Australia in recent decades.

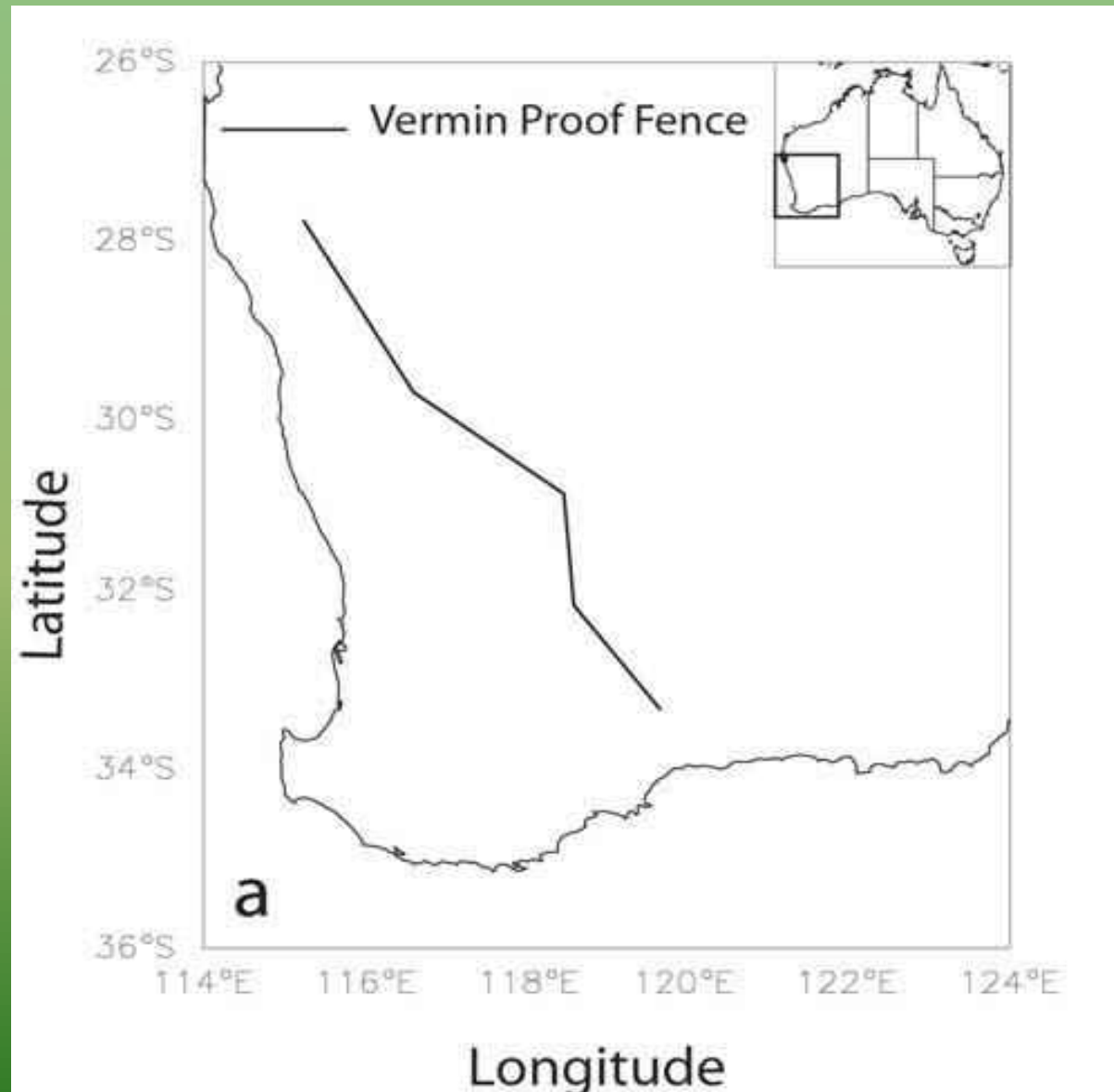
Source: Bureau of Meteorology

..Having Our Cake and Heating it too!

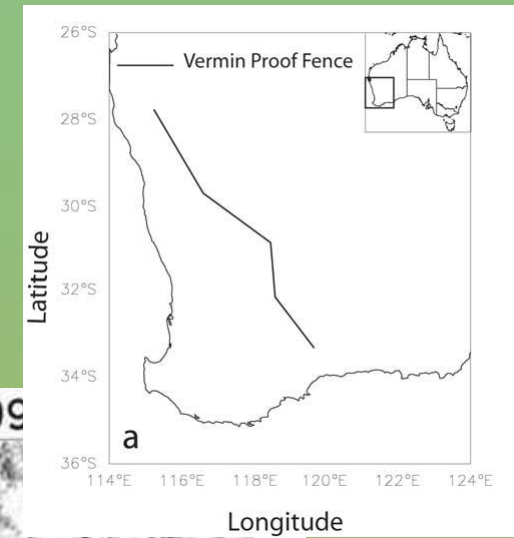
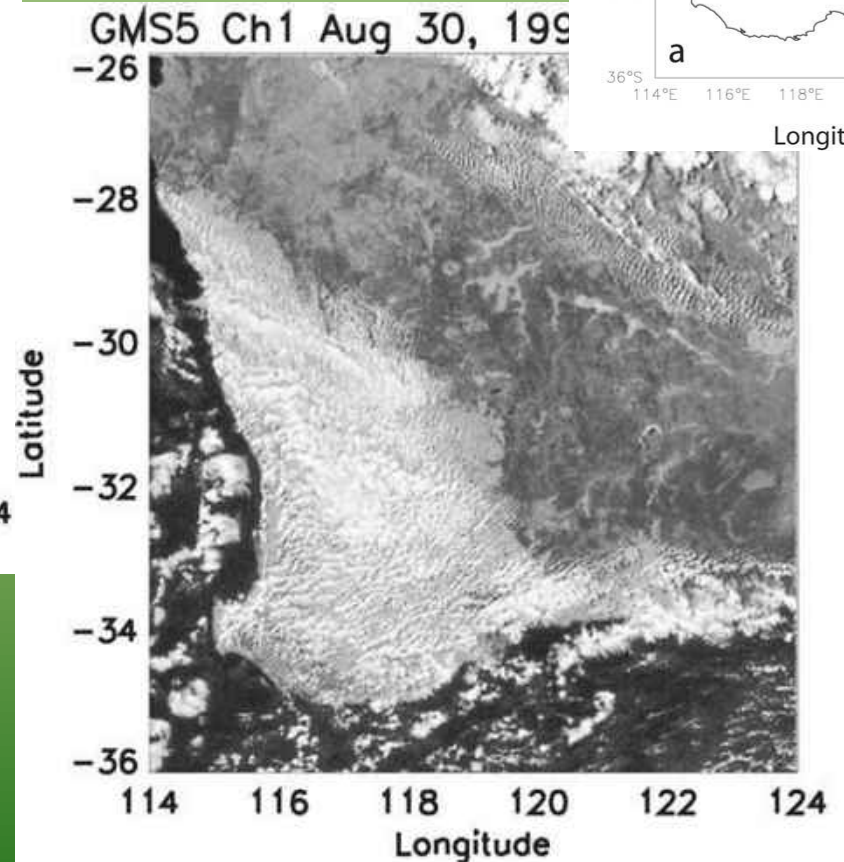
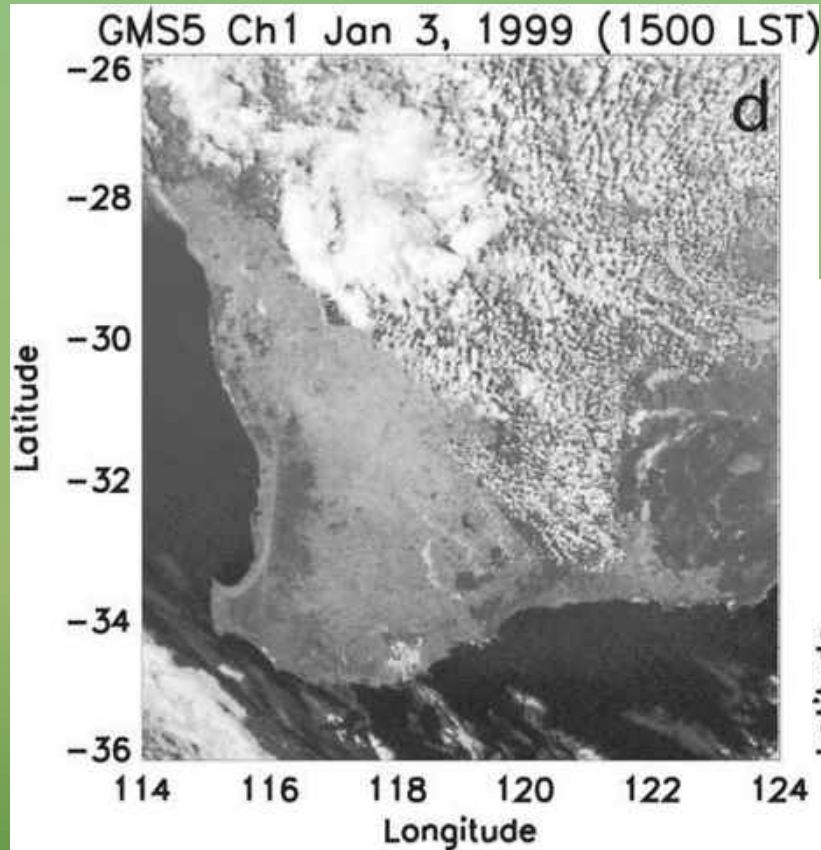
Most studies now project adverse impacts on crop yields due to climate change (3°C warmer world)



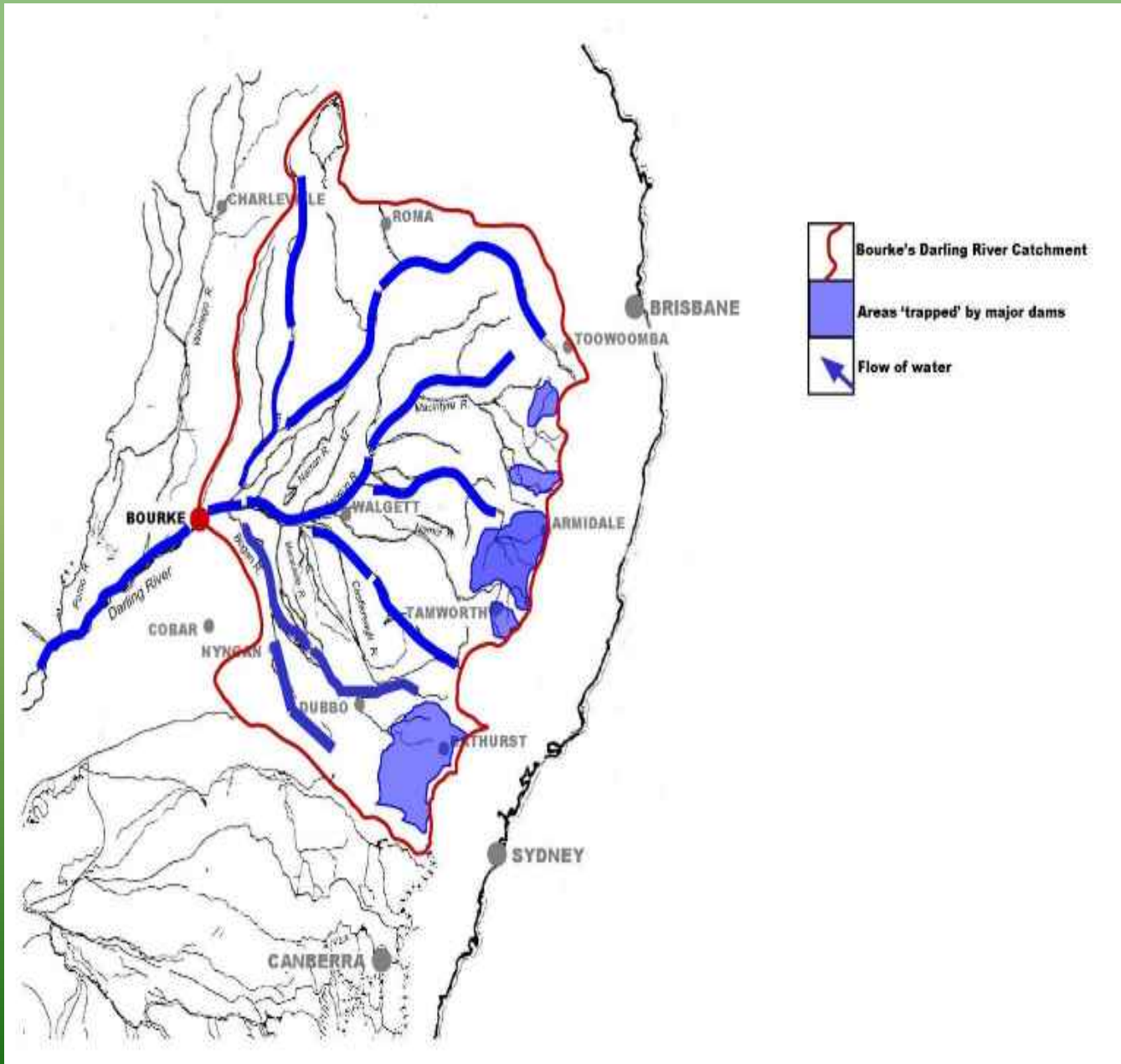
The Bunny Fence Project



The Bunny Fence Project



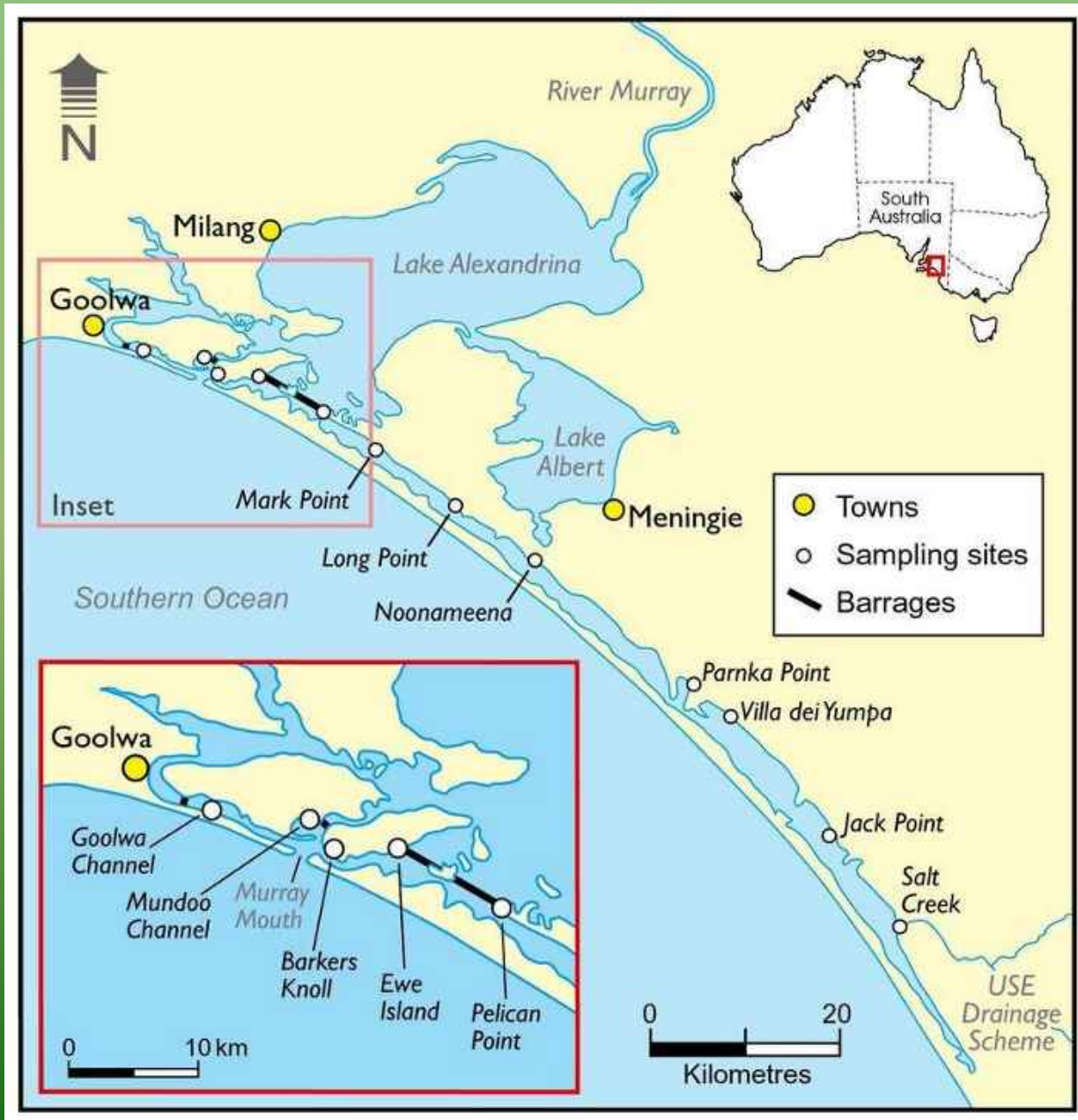
The Murray Darling Basin



The Mouth of the Murray



The Murray Darling Basin





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