

The Oxford Farming Conference 2010

# Approaching the limits:

Feeding 9+ billion humans whilst sustaining civilisation

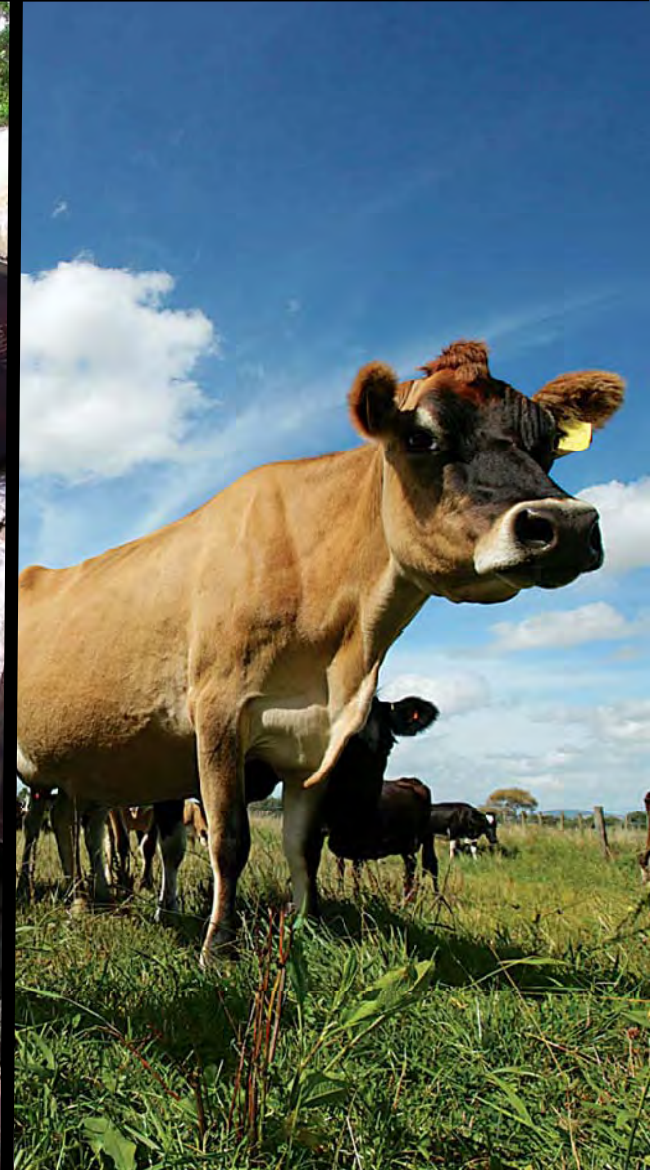
Dr Andrew West, Chief Executive  
AgResearch Ltd



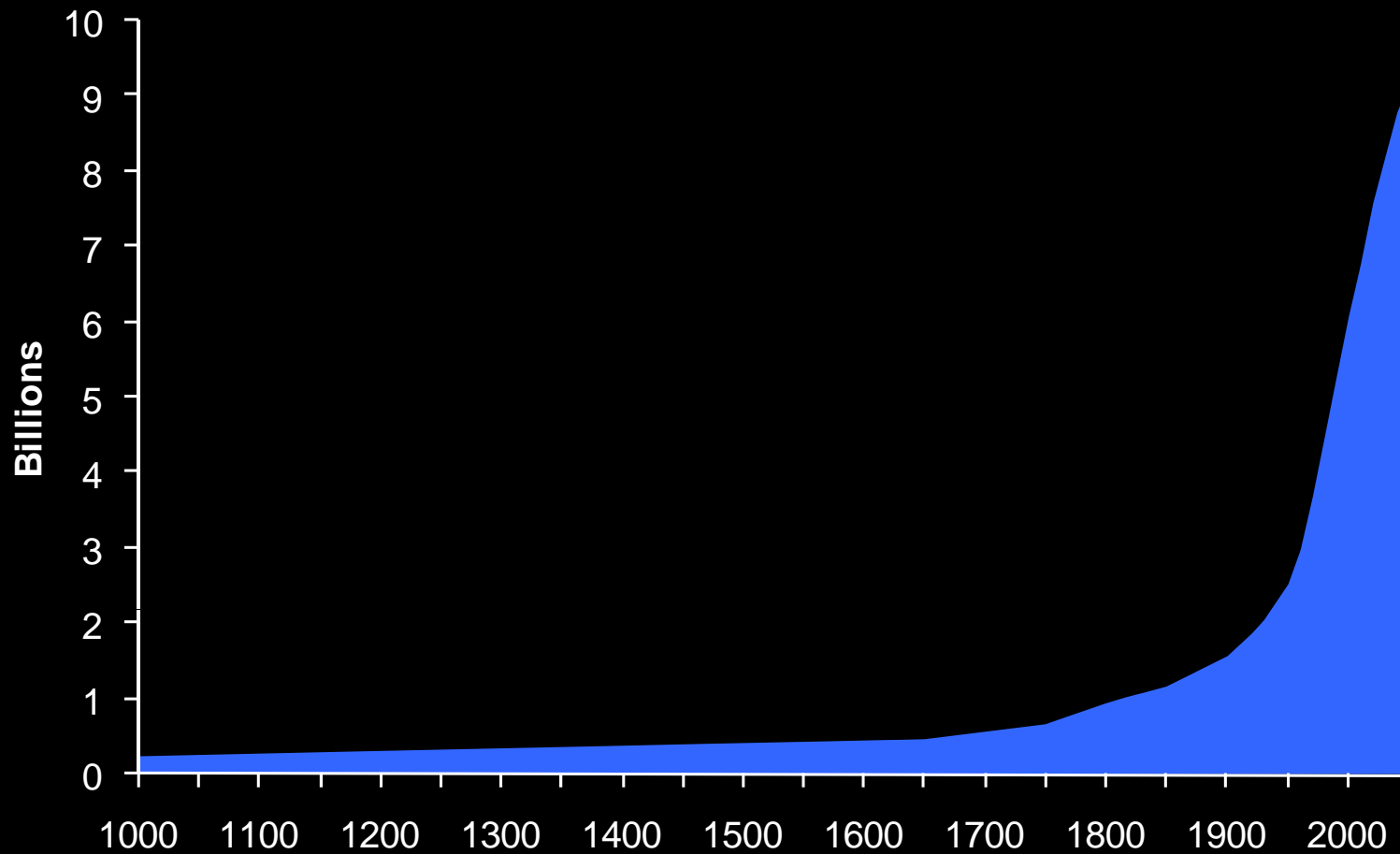
Farming, Food and Health. **First**

*Te Ahuwhenua, Te Kai me te Whai Ora. Tuatahi*

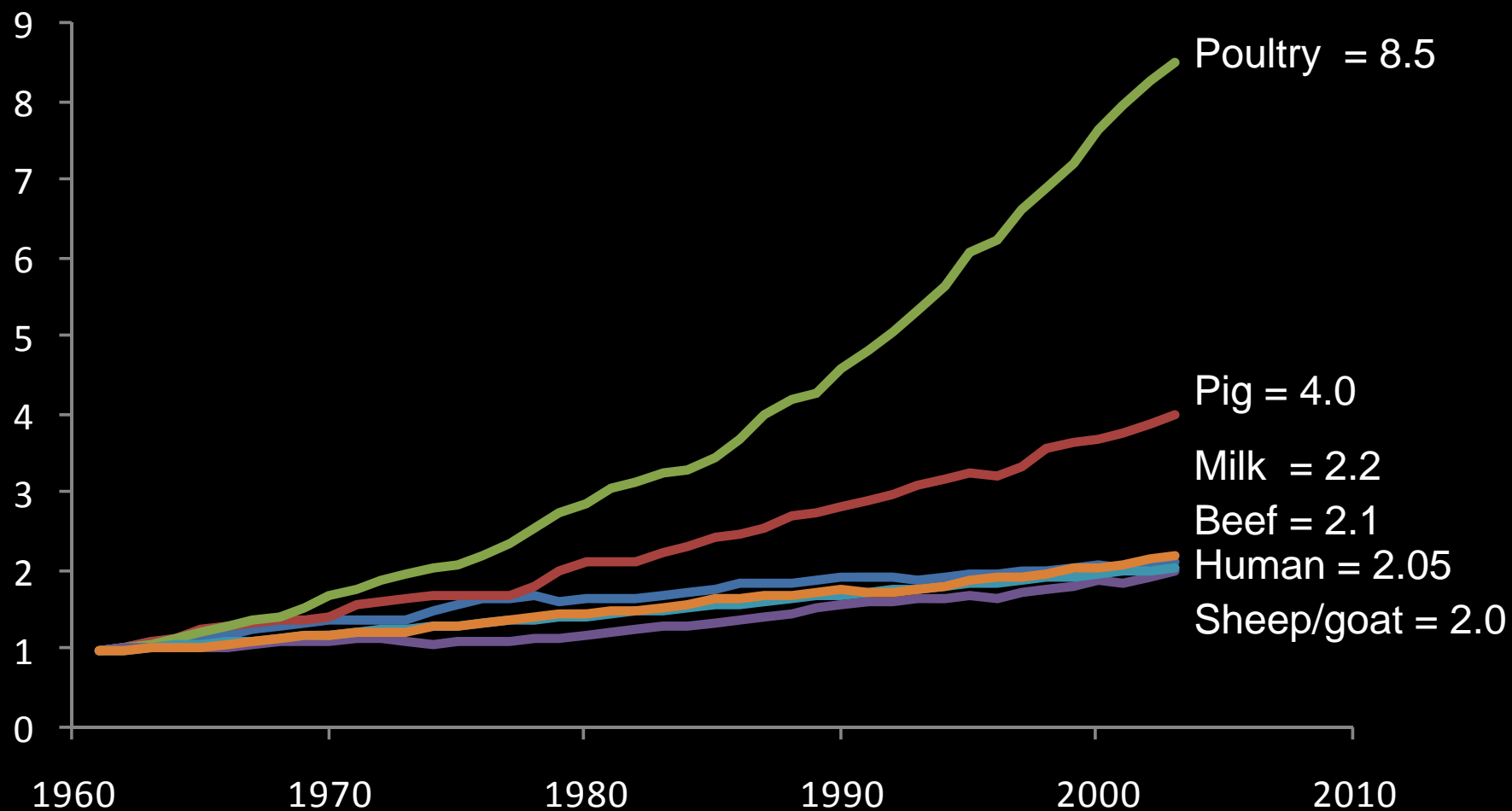
# Crises

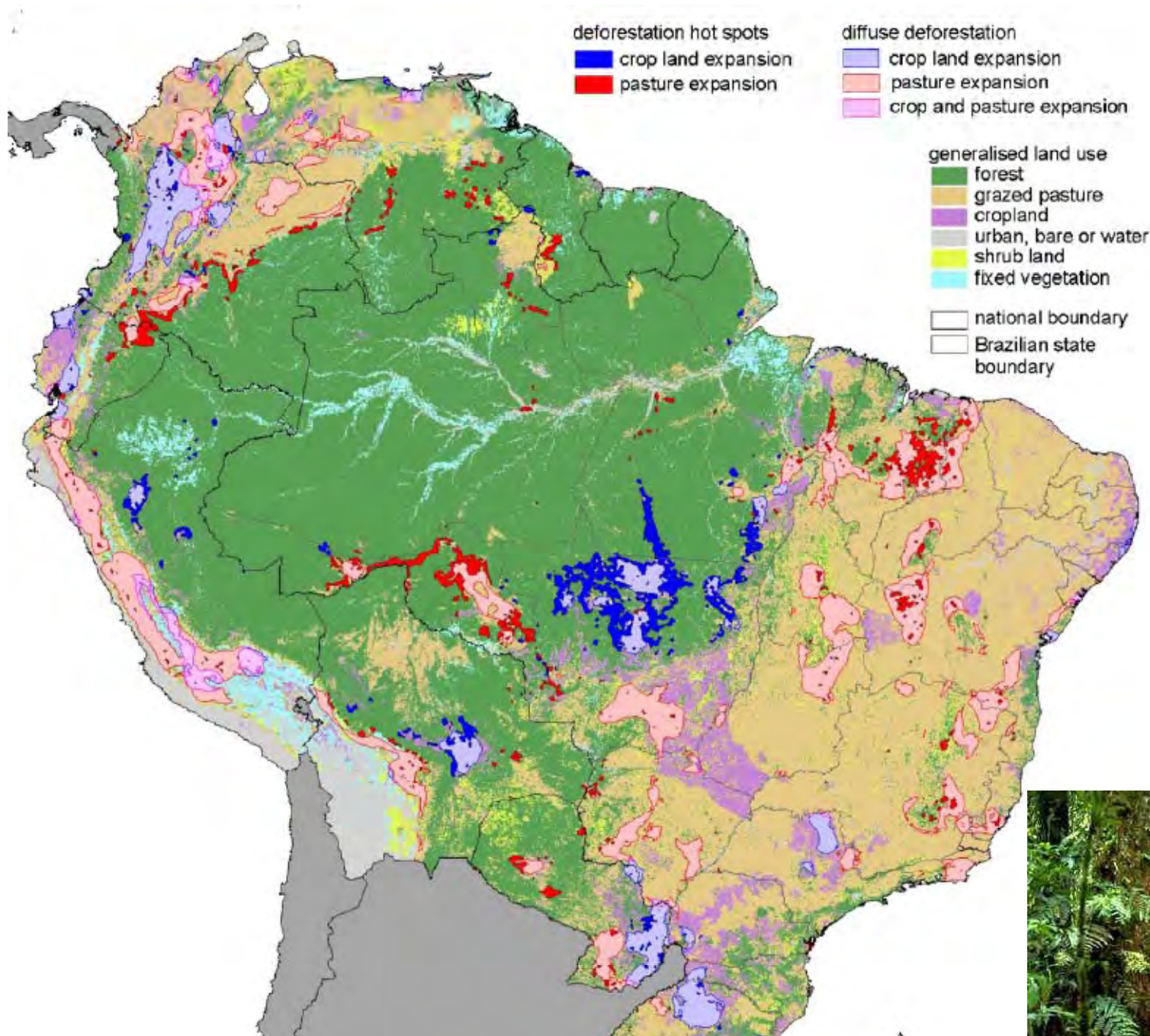


The world's population has grown tremendously – forecast to continue to 2050



# Indices of population and production 1960 = 1





Tropical deforestation is responsible for 20% of anthropogenic CO<sub>2</sub> emissions.

Net deforestation worldwide ~7.3 million ha per yr



[Source: Wassenaar, T. *et al.* (2007) Projecting land use changes in the Neotropics: The geography of pasture expansion into forest, *Global Environmental Change*, 17, 86–104.]

# Extinctions



Species known to be extinct due to human activity in the last 500 years:

**785**

**Species facing a high risk of extinction:**

Mammals: **1 in 4**

Birds: **1 in 8**

Amphibians: **1 in 3**

Tortoises, freshwater turtles: **almost 1 in 2**

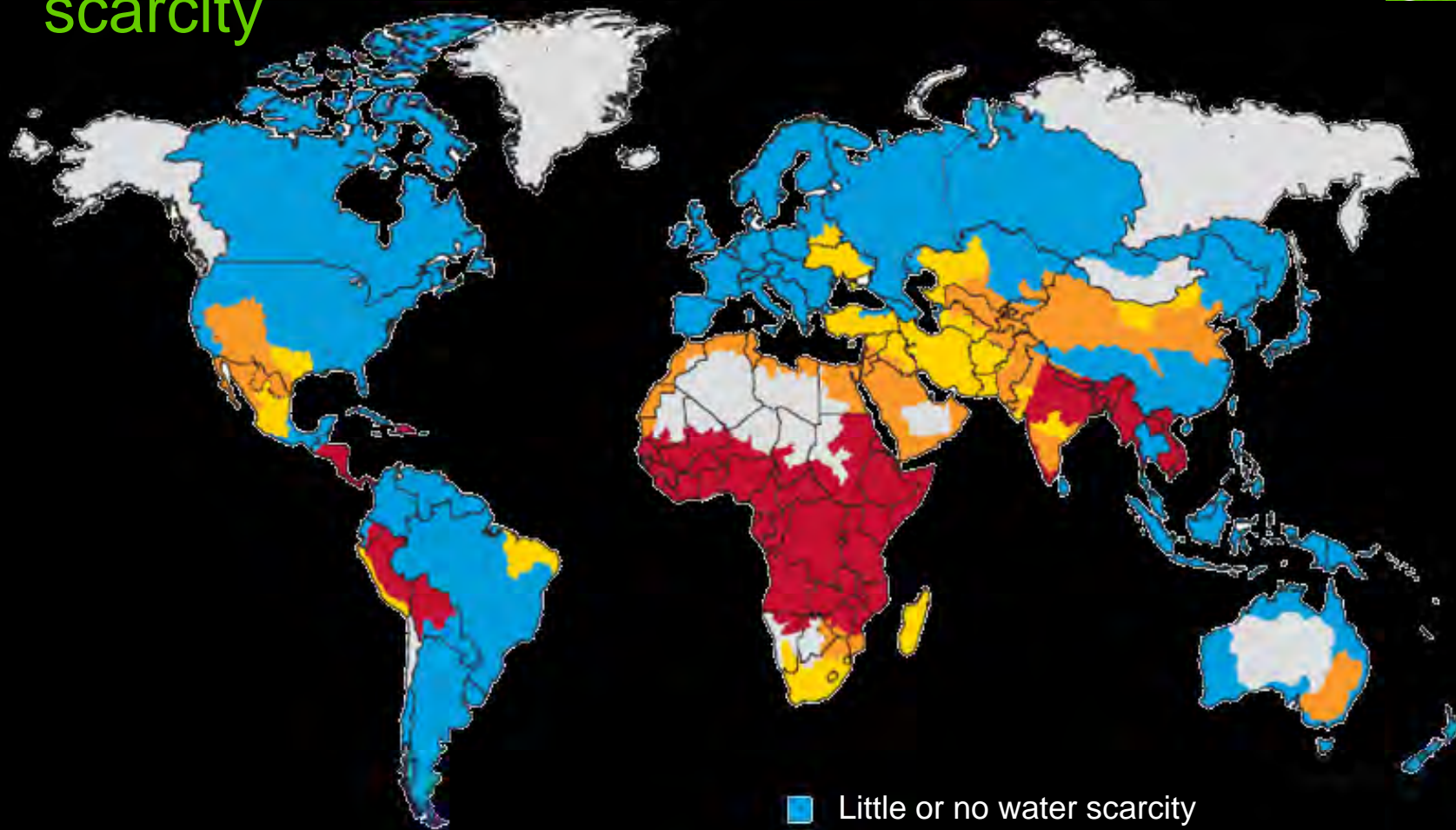


Estimated ratio of the current rate of extinctions to the normal background rate:

**100 to  
10,000**

# Areas of physical and economic water scarcity

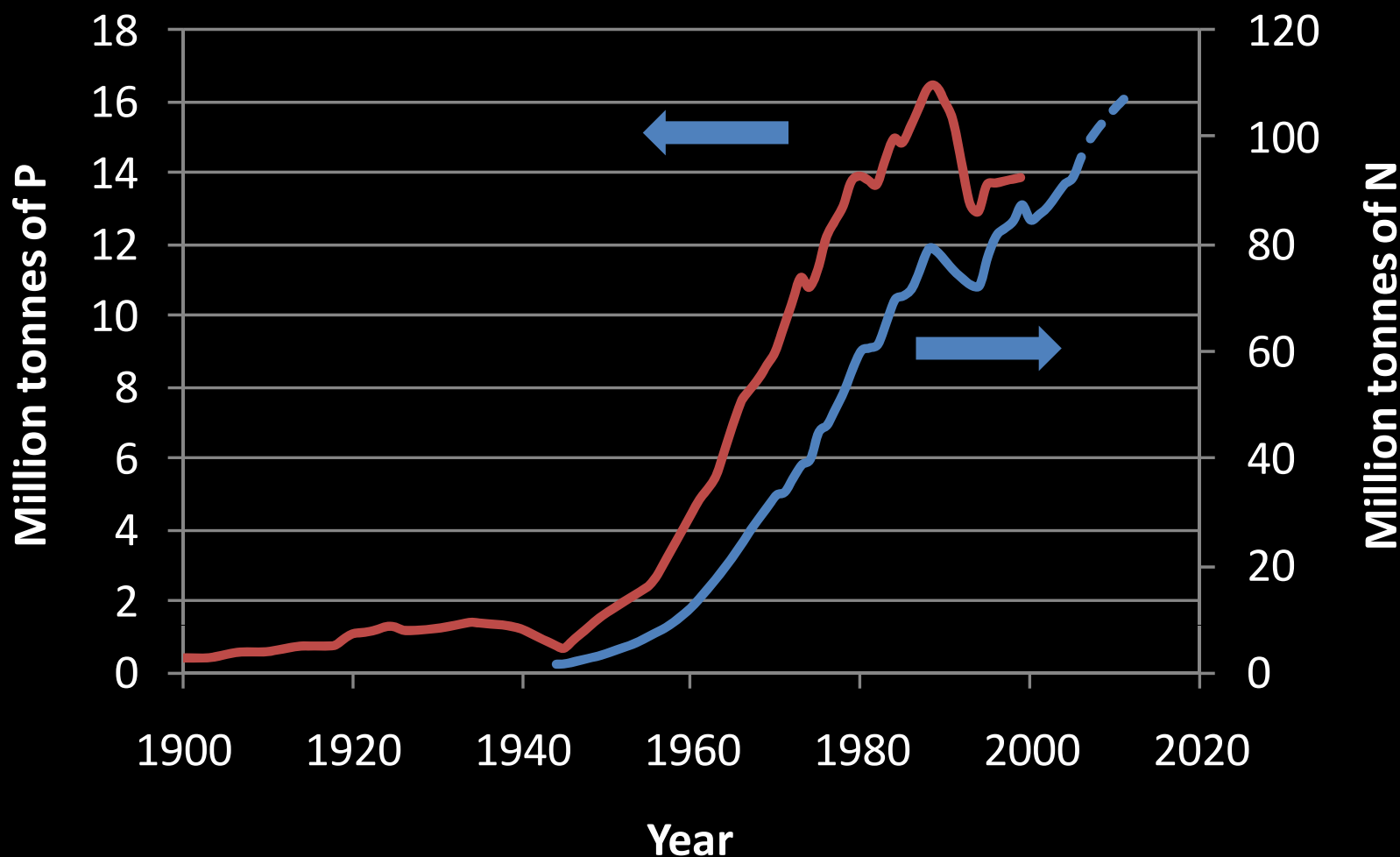
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- Little or no water scarcity
- Physical water scarcity
- Approaching physical water scarcity
- Economic water scarcity
- Not estimated

[Source: WBCSD (2009) *Facts and Trends - Water, version 2*, World Business Council for Sustainable Development, [<http://www.wbcd.org/DocRoot/ID1tMGiLZ7NL9mBOL2aQ/WaterFactsAndTrends-Update.pdf>]

# World consumption and production of fertiliser



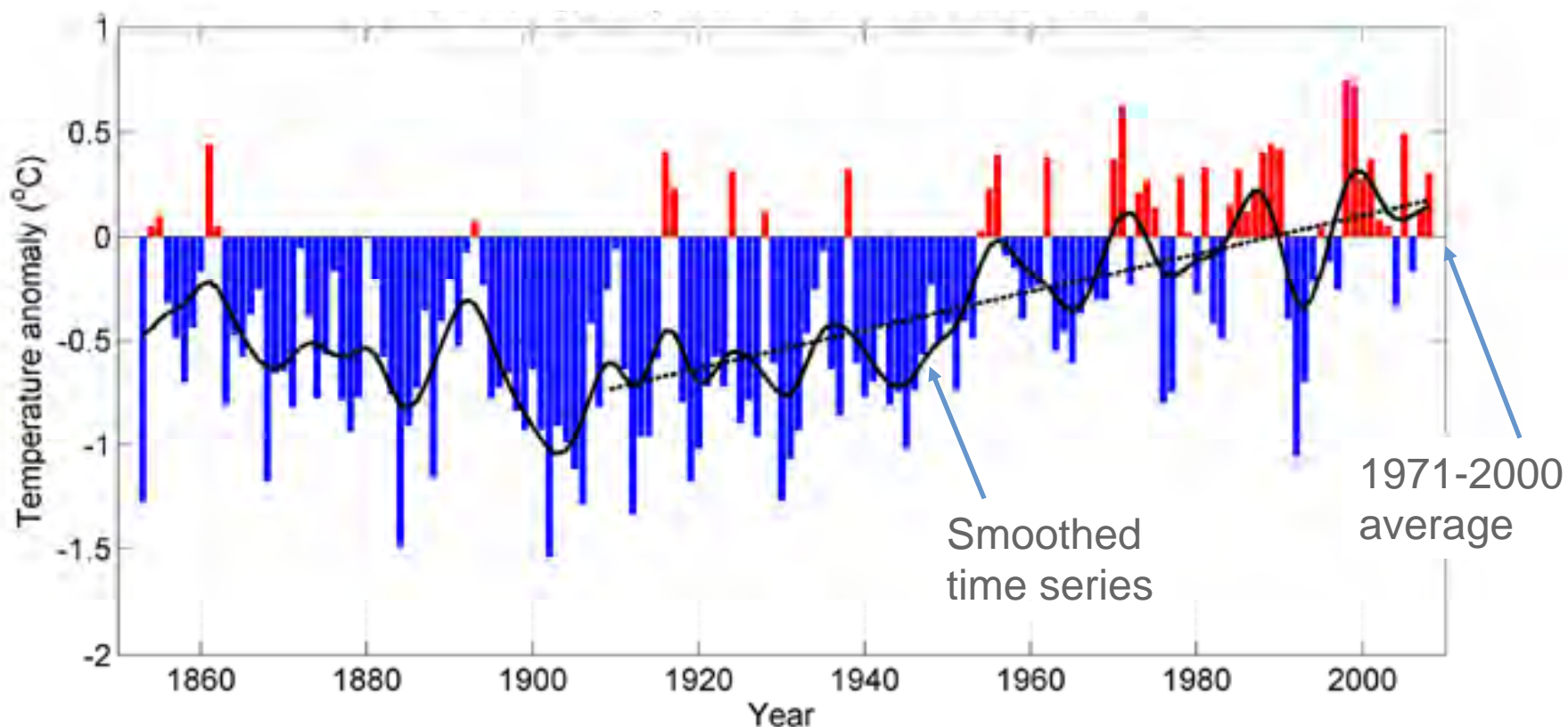
[Sources: Smil, V. (2002) *The Earth's Biosphere: Evolution, Dynamics and Change*, The MIT Press, Cambridge, MA, USA, Ch.9; EFMA [http://cms.efma.org/EPUB/easnet.dll/GetDoc?APPL=1&DAT\\_IM=0010FA&DWNLD=WorldConsumption2.pdf](http://cms.efma.org/EPUB/easnet.dll/GetDoc?APPL=1&DAT_IM=0010FA&DWNLD=WorldConsumption2.pdf) ]





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# Mean annual temperature over New Zealand – 1853 to 2008



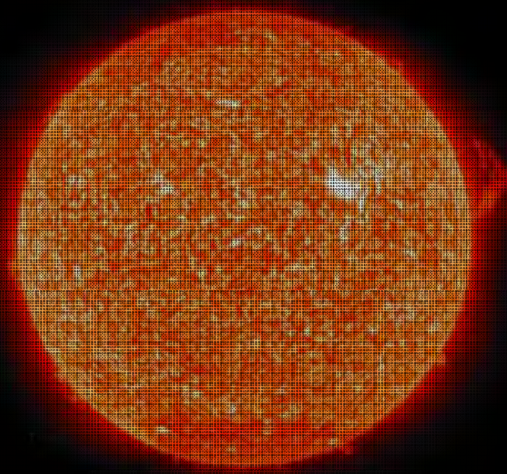
# Lovelock's Gaia theory

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4 billion years ago



Avg. temperature  $\sim 15^{\circ}\text{C}$

Today



Avg. temperature  $\sim 15^{\circ}\text{C}$



**How?**

# Gaia might shift its steady-state to be 4-5°C warmer – consequences?

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## Major changes in rainfall patterns



Wildfires

## New patterns of pest distribution



# Falling fertility





GM

# Non-carbon sources of energy



Solar



Tidal



Geothermal



# Removal of “traditional” individual rights

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# Change in diet

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# Possible New Zealand response

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# What does this mean for New Zealand?



Land area larger than the UK

~4.5  
million  
people

Isolated  
location

Low pest  
levels

Tectonic plate boundary  
– hills and mountains

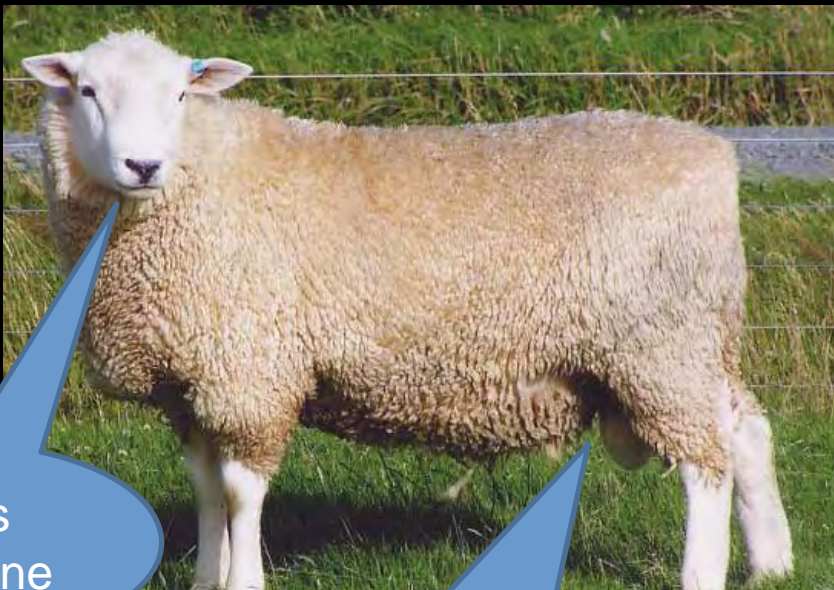


Plenty  
fresh  
water

High  
erosion

Ruminants harvest hard-  
to-reach plant mass

# Reduce the environmental impact of farming



Less methane

Improve efficiency  
– less need for N & P fertiliser

Less nitrogen and nitrous oxide

Sequester carbon



# Grass & clover fed, rainfall, legume N?

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# Integrated value chains

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# Use every available part of a ruminant

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# Plants in their own right

