



# Sustainable intensification and the role of science and technology in meeting the food security challenge

Dublin Nov 28<sup>th</sup> 2013

**Charles Godfray**

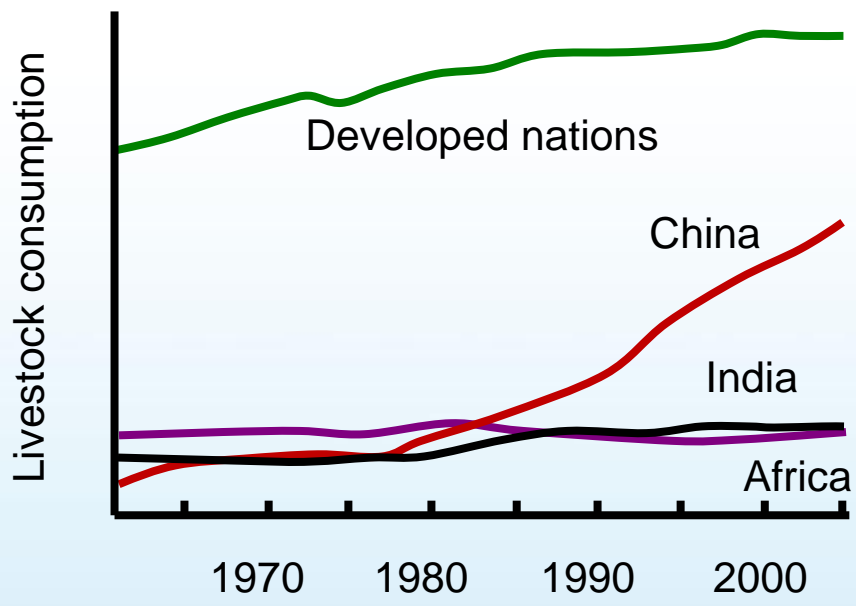
Department of Zoology & Director,  
Oxford Martin Programme on the Future  
of Food



# Increasing demand

- Population most likely to peak ~10B

Livestock consumption (FAO 2009)



**SINGLE BYPASS BURGER®**



**DOUBLE BYPASS BURGER®**



**TRIPLE BYPASS BURGER®**



**QUADRUPLE BYPASS BURGER®**



# Threats to supply

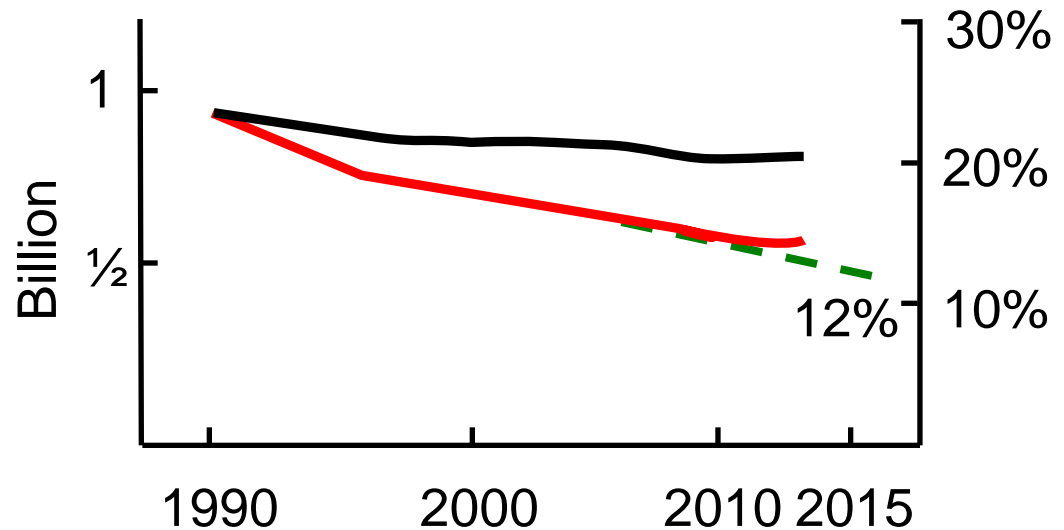
- Global water crisis
- Increased competition for land
  - Land degradation
- Climate change
  - General warming
  - Increase in extreme events
- Human amplification



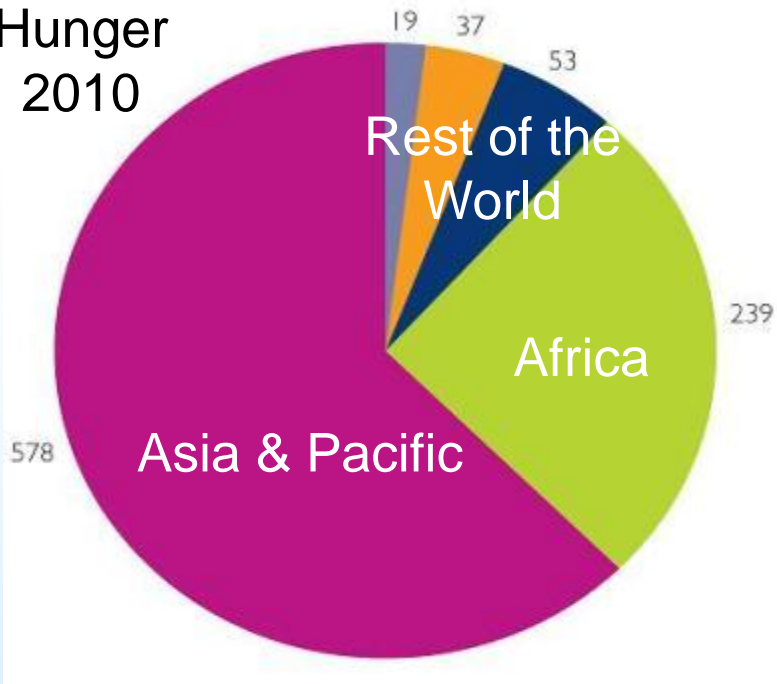
# Hunger

- ~1B hungry, most in Africa and Asia
- Unlikely to meet MDG 1

World Hungry (FAO 2012 update)



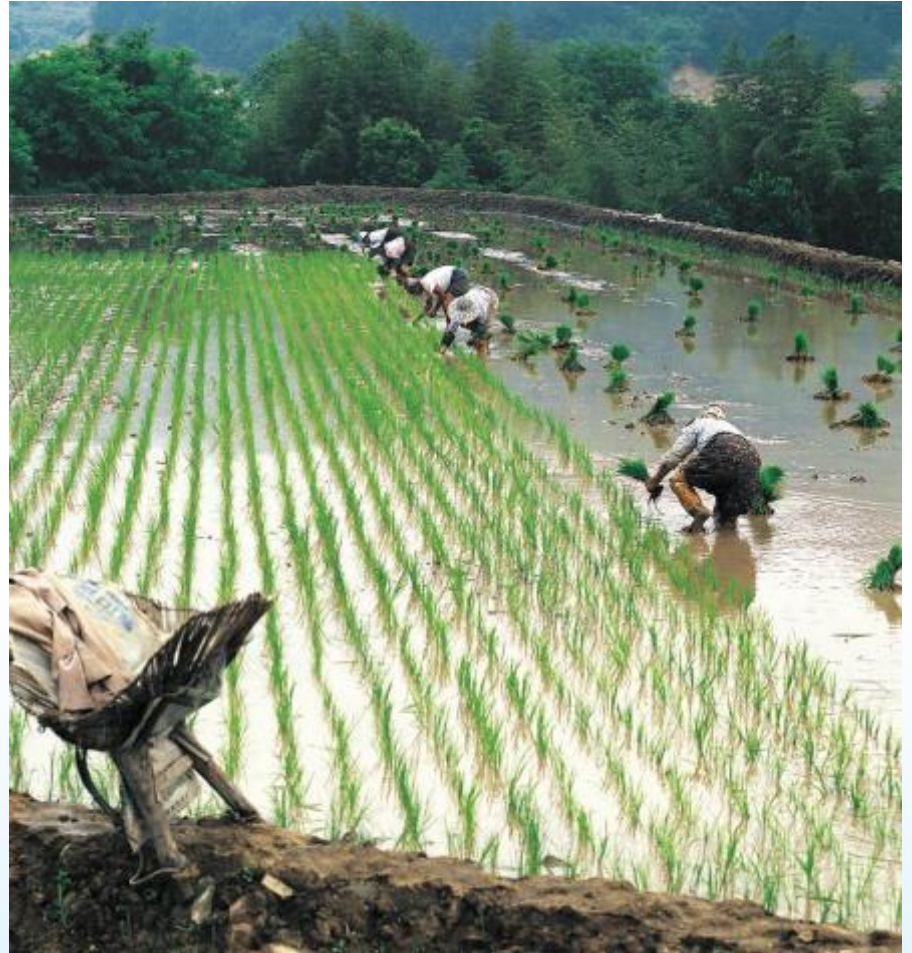
Hunger 2010



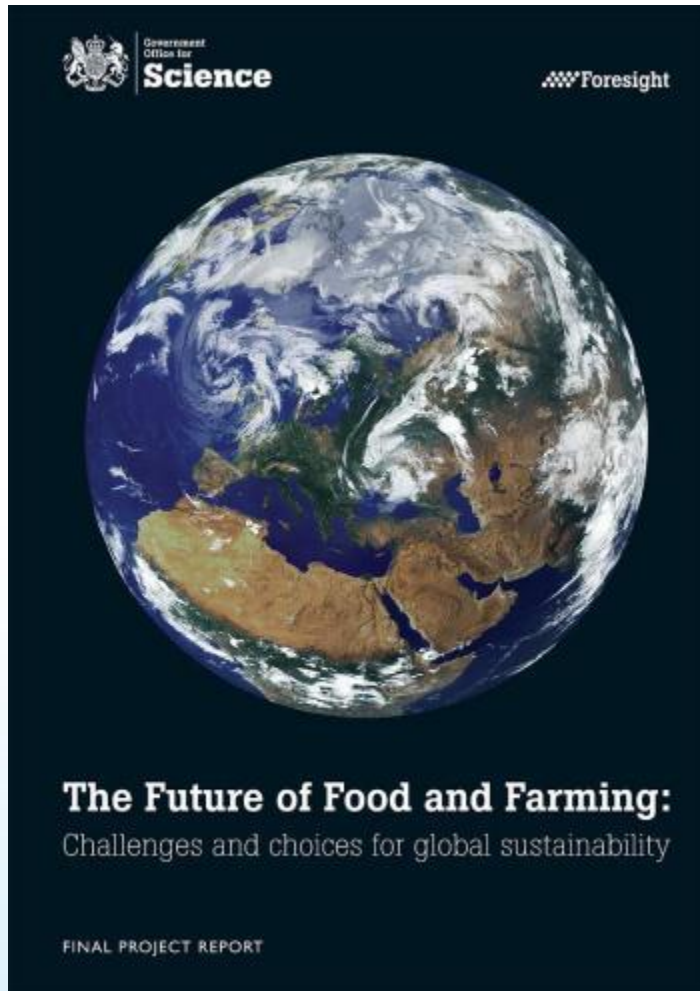
- Physical, economic & social access to food
- “Hidden hunger” (~1B)
- “Over-nourished” (~1B)

# The food system is not sustainable

- Uses ~70% of global water, much non-renewable
- ~24% of vegetated land suffers soil degradation
- ~30% greenhouse gas emissions come directly or indirectly from food system
- Main source of nitrate and other pollution
- Most fisheries over-exploited



# UK Foresight Report



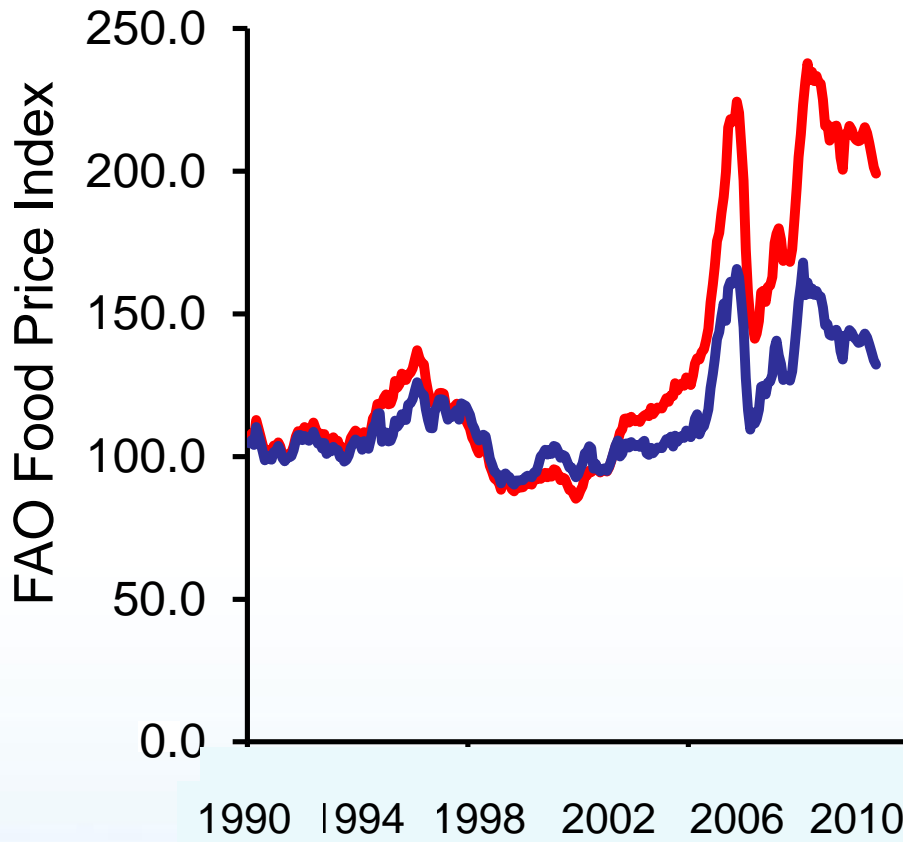
## Future of Food & Farming

- Food security
- Sustainability
- The needs of the poorest

Report available at

<http://www.bis.gov.uk/foresight>

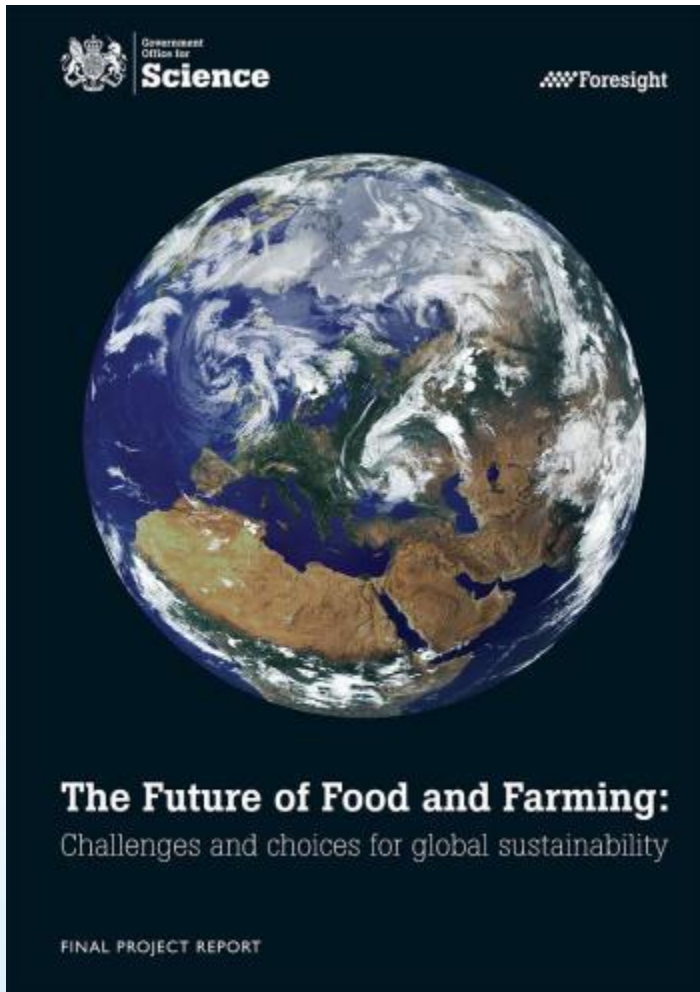
See also, Godfray *et al.* 2010, *Science*  
327, 812-8



*UN Food and Agriculture Organisation 2013*

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# UK Foresight Report



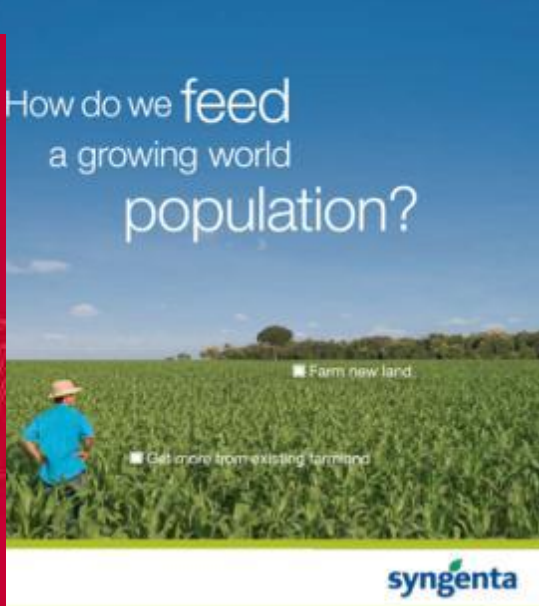
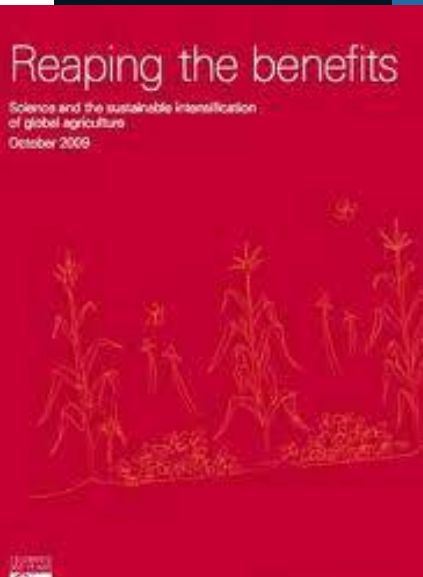
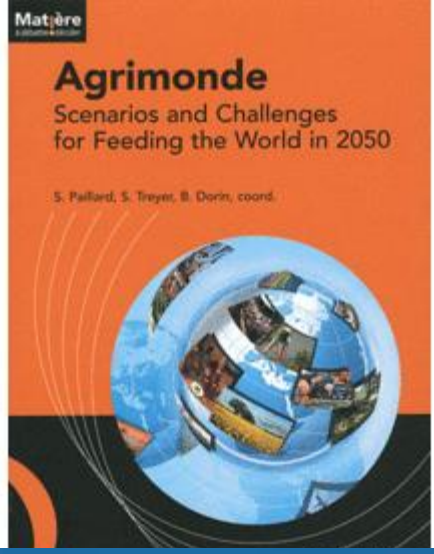
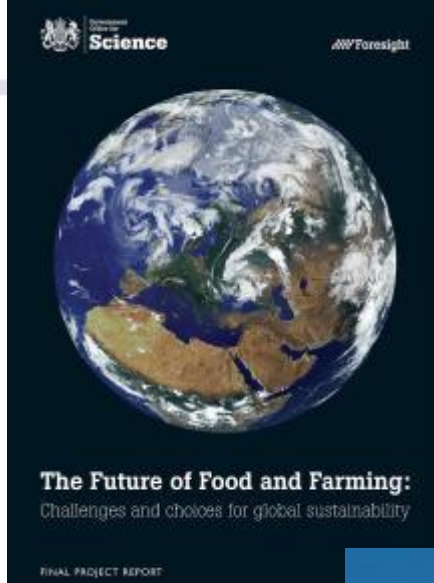
Challenges sufficiently pressing action needed on

- Increasing production
- Moderating demand
- Reducing waste
- Improving governance



# Production side response

- **Sustainable Intensification (SI)**
  - Higher yields, less env. impact
- Incorporated into policy (government, private sector, NGOs)
- Reaction



## A Wolf in Sheep's Clothing?

An analysis of the 'sustainable intensification' of agriculture



**Sustainable intensification - an oxymoron**

...of our planet. How do we provide...  
 ...we believe the answer lies in the...  
 ...and better ways to produce crops from...  
 ...farmland and have less new land into...  
 ...the world to meet the challenge of the...  
 ...www.growmorethomorrow.com

*Bringing plant potential to life*

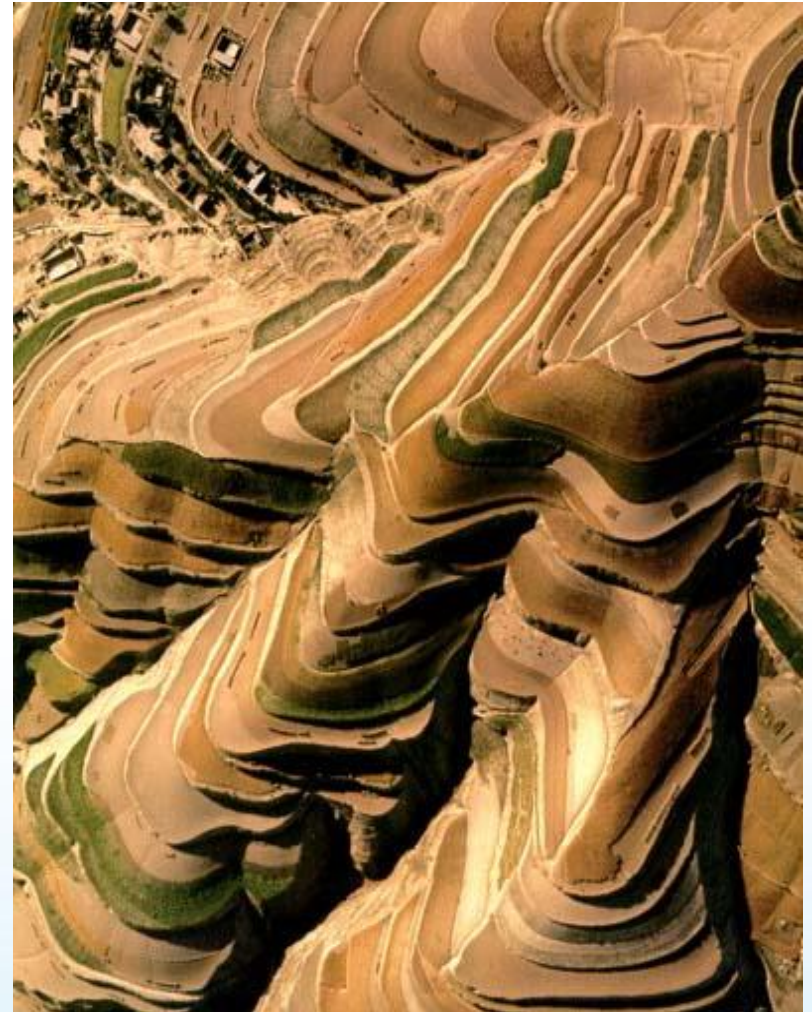
# 1. Action needed on all fronts

- Moderate demand, reduce waste, improve governance ...
- ... but also produce more food
- SI is neither a “productionist silver bullet” nor special pleading by the agricultural sector
- Facilitate sustainable response to price signals



## 2. Very limited new land

- Major environmental costs to land conversion – GHG emissions & biodiversity
  - Restoration of agricultural lands a priority
- Pressure from other land uses
  - Urbanisation
  - Climate change
  - Biofuels daftness



### 3. It's not Sustainable Intensification

- Don't mistake SI as business-as-usual with marginal improvements in environmental impact
- Genuinely radical if taken seriously
- Overall yield growth but
  - Some local reductions
  - Some land sparing



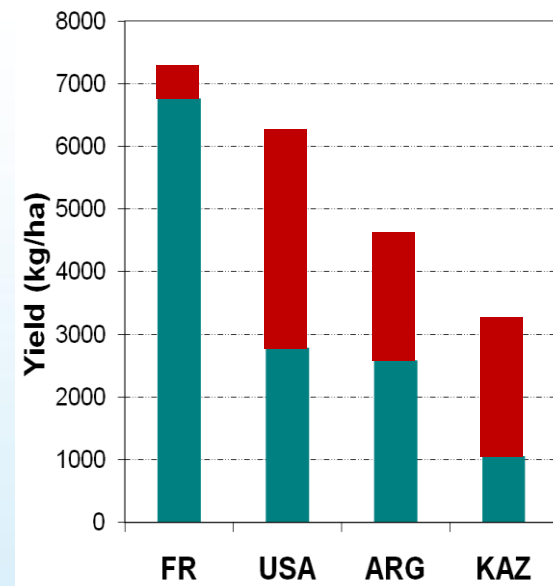
## 4. A Goal not a Trajectory

- Evidence based and context specific
- Pick the best from conventional, “high-tech”, agro-ecological, organic
- What would this look like in practice?



# Producing more using existing knowledge

- Closing the yield gap
  - Price signal responses and market failures
- Research gaps and needs
  - Sustainability – leap-frogging technologies
  - Sustainability – multifunctional landscapes
  - The behavioural economics of change
  - Revitalising and remodelling extension



# Innovation to increase production

- Investment works
  - Green revolution
  - Brazil & China
- Refocused research
  - Resource efficiency
  - Reduce externalities
  - Needs of the poorest
- Issues
  - Time lags
  - Public/private investment
  - Public acceptance



- Are we reaching yield ceilings?
  - Neglected crops
- Insights from evolutionary biology
  - Simple individual traits
  - Group traits
  - New variation
  - Radical redesign
  - Skewing the red queen
  - Learning from nature
- Game changers
  - Artificial meat
  - Pest & disease control

## Innovation to increase production





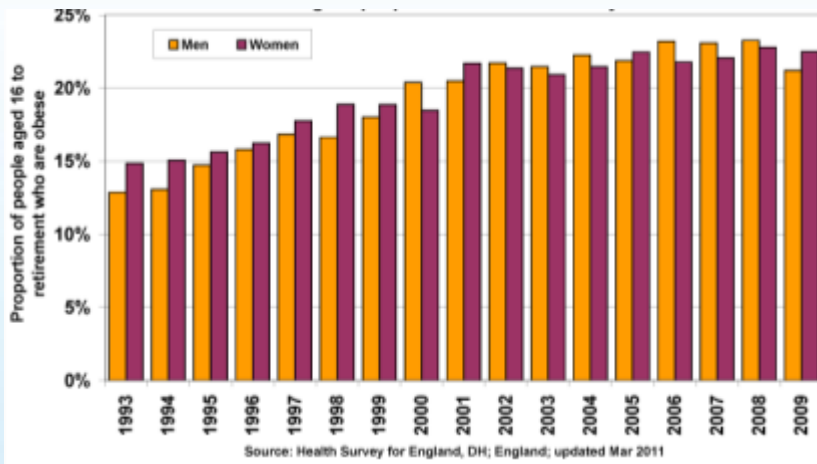
# Innovation to increase production

- Priorities
  - Modern biotech (including GM)
  - Cinderella subjects: agronomy, soil science
    - Tropical soils
    - Salinification
  - Precision agriculture (high- & low-tech)
  - ICT to improve yields, efficiency and resilience
  - New agricultural economics



# Influencing demand

- Imperative to act on population growth (largely in the poor world) ...
- ... and consumption (largely in the rich world)
  - It is impossible for 10B people to have a meat-rich western diet
- Obesity epidemic



# Influencing demand: what works?

- Education
  - Labelling
- Working with industry
  - Waste
  - Reformulation
  - Portion size
  - BOGOFFs etc.
- Harder questions
  - Advertising & marketing
  - Meat and dairy
- Social norms and legitimising action
- Lower income countries



# Conclusions

- Food system entering uncharted waters
- Action needed on all fronts
- Sustainable intensification (even if you call it something else) essential
- Reverse drop of investment in agricultural science – low- as well as high-tech
- We fail on food we fail on everything

