

# Confronting the Global Agricultural Crisis of the 21<sup>st</sup> Century



**World Food Prize, Des Moines, Iowa,  
October 15, 2008**

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# The Global Crises

**Financial**

**Terrorism**

**Food security**

**Energy Supply**

**Health Equity**

**Environmental  
Degradation**

**Climate Change**

# An English Cottage Loaf

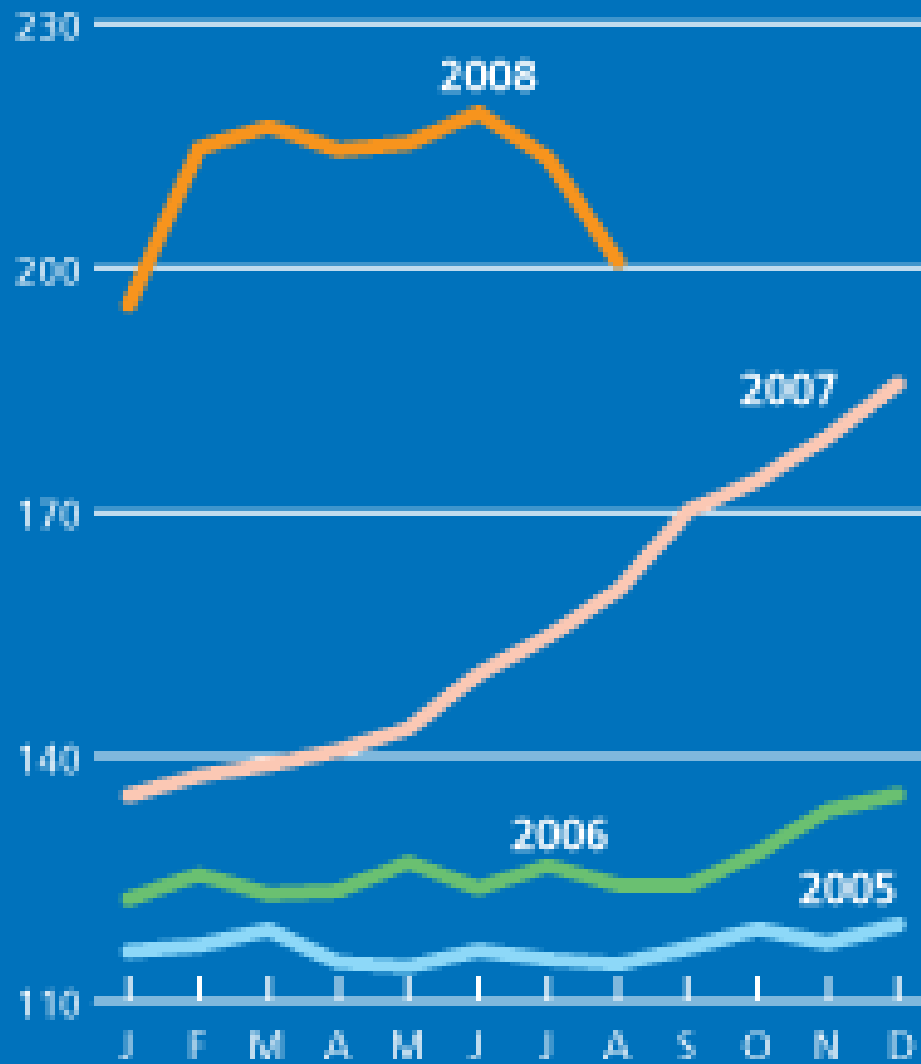


**Immediate  
Crisis  
on Top**

**Chronic Crisis  
beneath**

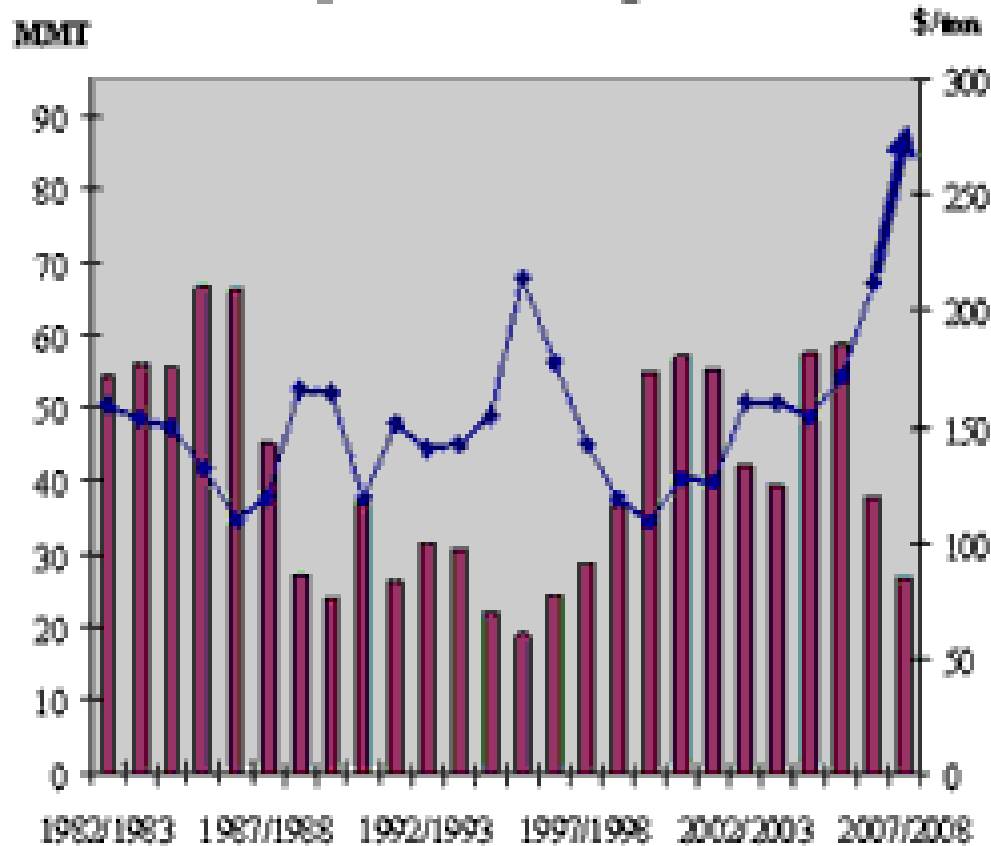
# FAO Food Price Index

1998-2000=100



# Grain stocks were falling rapidly

## Surging Prices Highly Correlated To Exporter Ending Stocks



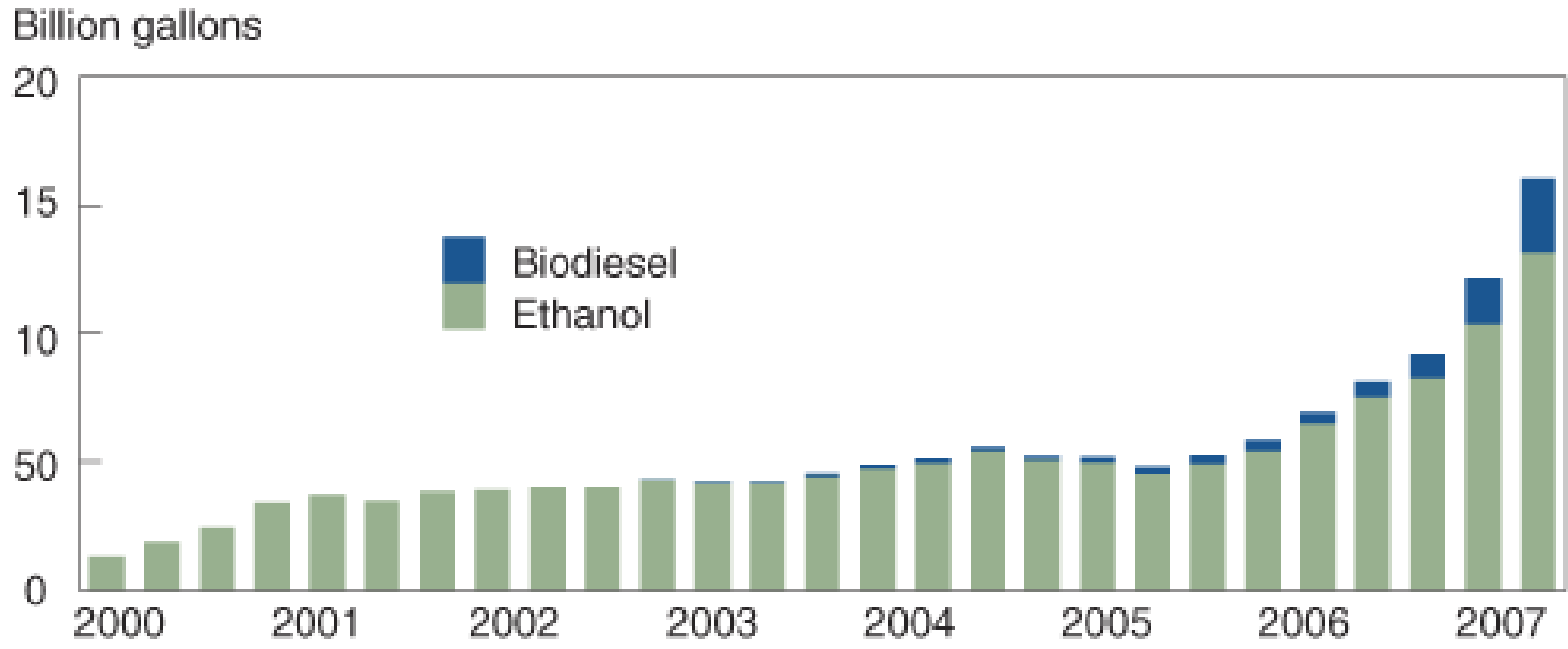
■ Ending Stocks for 4 Key Exporters: Australia, Canada, EU-27, United States  
◆ HRW FOB Price

<http://www.fas.usda.gov/grain/circular/2008/02-08/graintoc.asp>



# Biofuel demand was growing rapidly

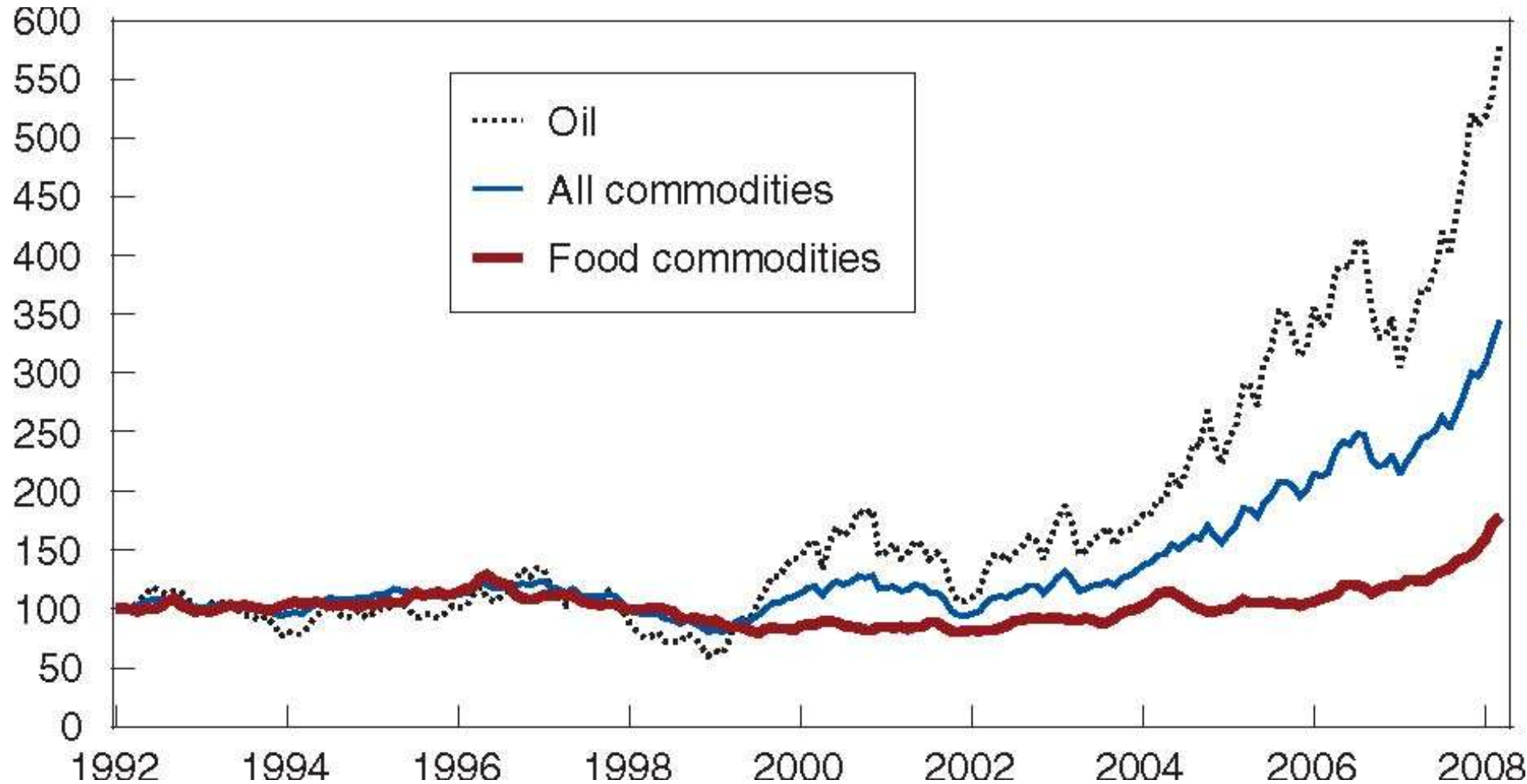
Global biofuel production tripled between 2000 and 2007



Source: International Energy Agency; FO Licht.

**A third of US maize crop to Ethanol,  
a third of EU rapeseed to Biodiesel**

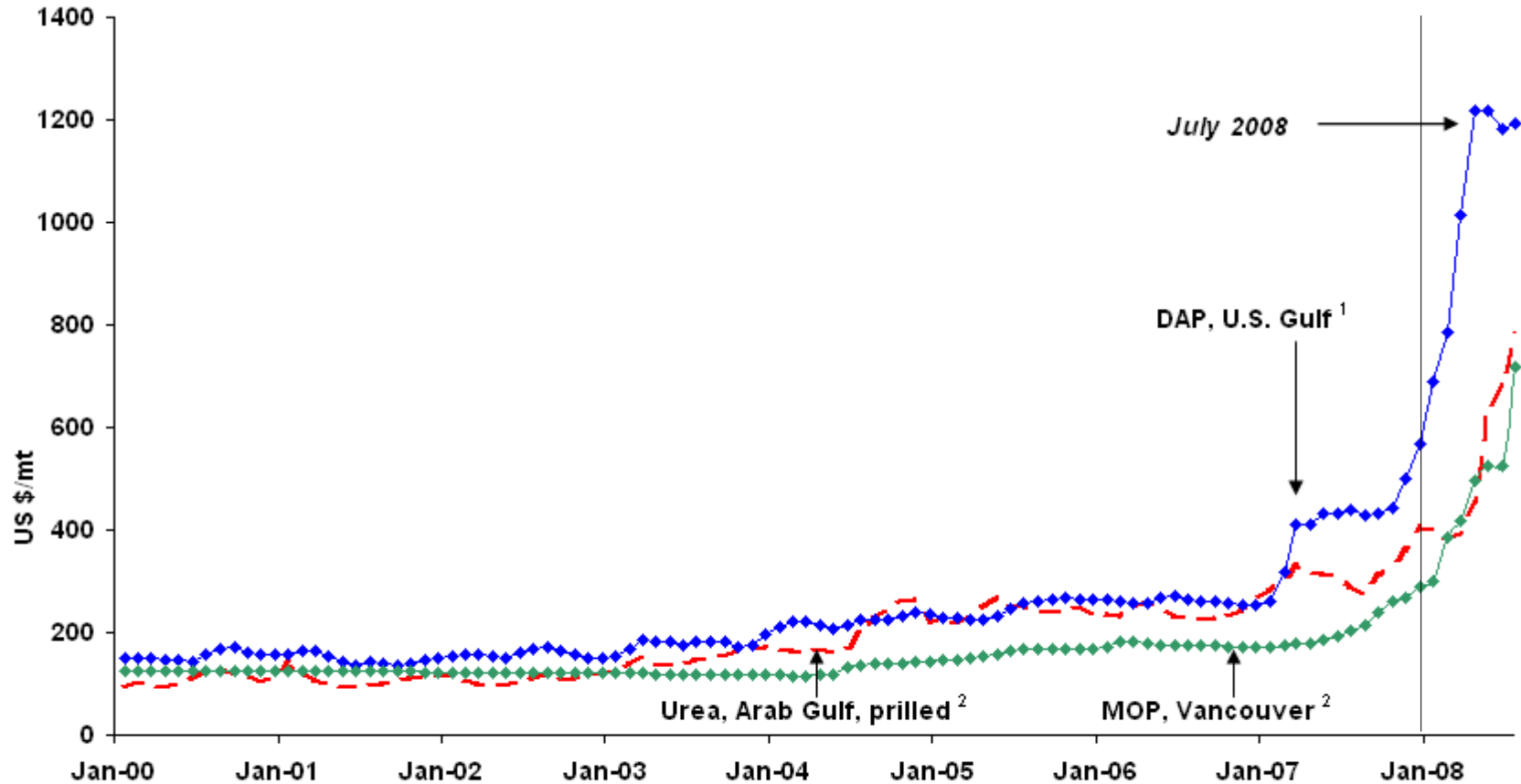
# As were oil prices



Source: Trostle, Ronald, Global Agricultural Supply and Demand: Factors Contributing to the Recent Increase in Food Commodity Prices, ERS, USDA, May 2008.



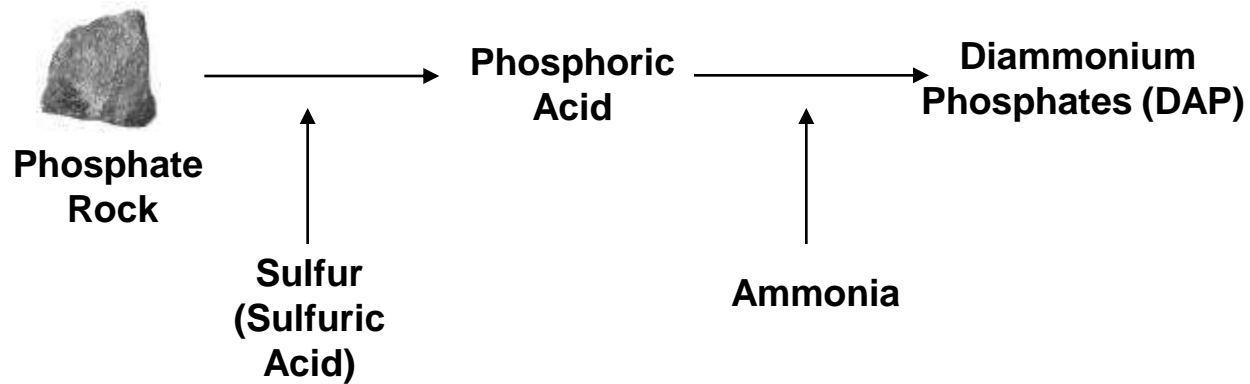
# With knock effects for Fertilizer Prices



1. Derived from *Green Markets*. 2. Derived from *FMB Weekly*.

FOB = free on board (average price, with buyer paying freight and insurance, to destination port). DAP = diammonium phosphate. MOP = muriate of potash.

# The Costs of Fertiliser Production Making Phosphates



1 Ton Sulfur Produces ~ 2 ton of DAP

**How do we make fertilisers  
cheaper and more accessible?**

**The Food Crisis has created  
100 -150 million more hungry people**



# Adding to the:

- **Over 850 million chronically undernourished**
- **180 million children severely underweight for their age**
- **400 million women of child bearing age anemic**
- **Over 200 million children vitamin A deficient**

# **Underlying the spike is a chronic crisis which is getting worse**

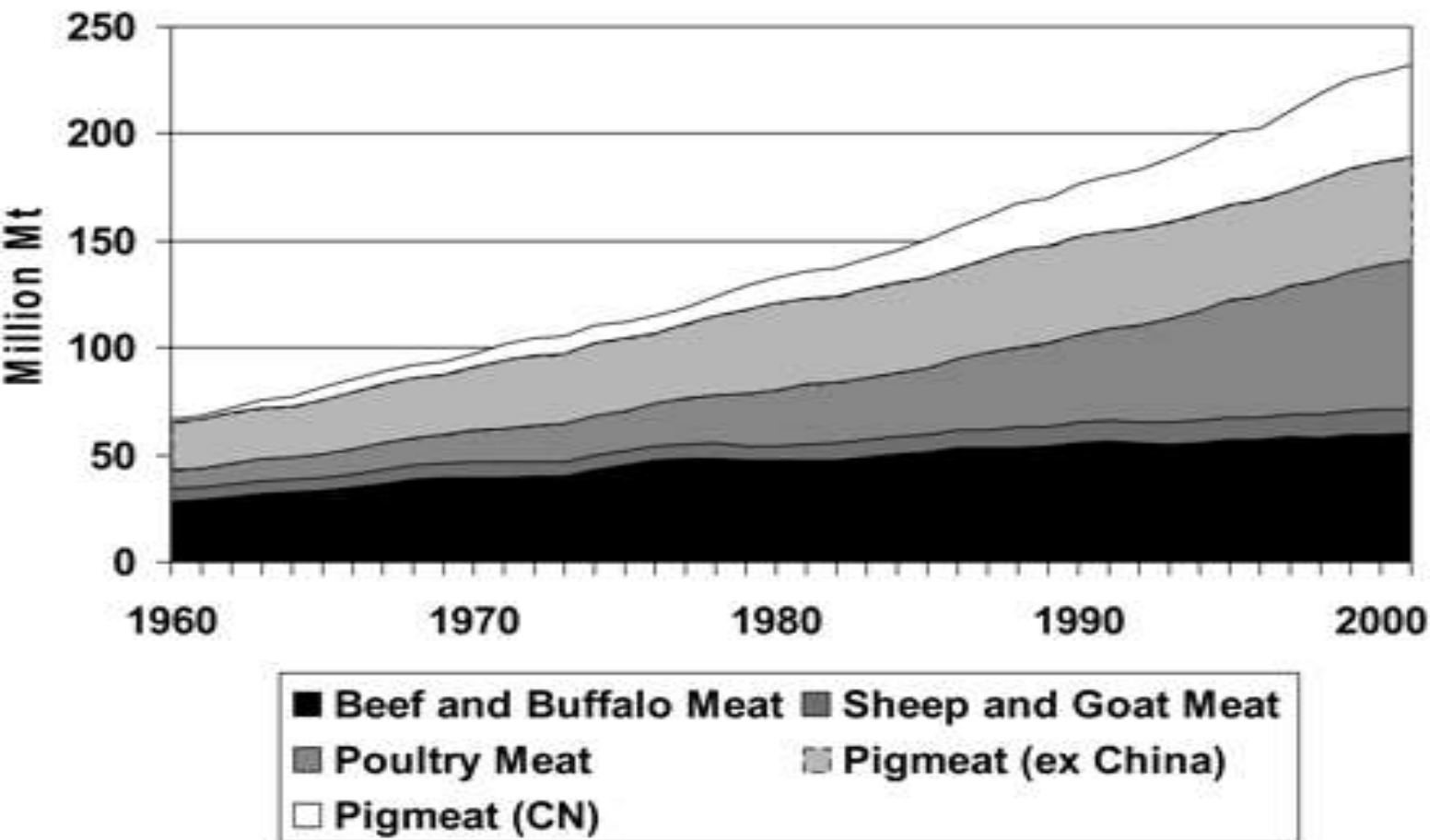
- **The Drivers**

- **Rising populations**
- **Rising per capita incomes**
- **Growing demand for livestock products**
- **Growing demand for biofuels**
- **Increasing water and land scarcity**
- **Impact of climate change**
- **Slowing of productivity increases**

# How do we cope with the pressure on the Land?

- For food and feed crops
- For biofuel
- For industry and urbanisation
- For forestry
- For pasture and range
- For ecosystem services
  
- **Is there enough?**
- **Will the poor benefit?**
- **How can we manage market forces to get an equitable and sustainable solution?**

# Meat Consumption



How do we:

greatly improve livestock conversion efficiencies?

reduce Greenhouse gas emissions from livestock rearing?

# The Biofuel Crop Dilemmas

- Why are we growing them?
  - Energy security
  - Farmer income
  - Carbon reduction
- We need to be explicit
- We need to carefully analyse the full costs and benefits for each crop in each location



# Assessing a biofuel

- **Is it profitable?**
- **Is it cheap?**
- **Is it environmentally friendly?**
- **Is it socially acceptable?**
- **Does growing it benefit the poor?**
- **Factoring in all the inputs and land use changes, is it carbon neutral or better?**

# How quickly can we move to 2<sup>nd</sup> and 3<sup>rd</sup> generation biofuels?

litres per ha

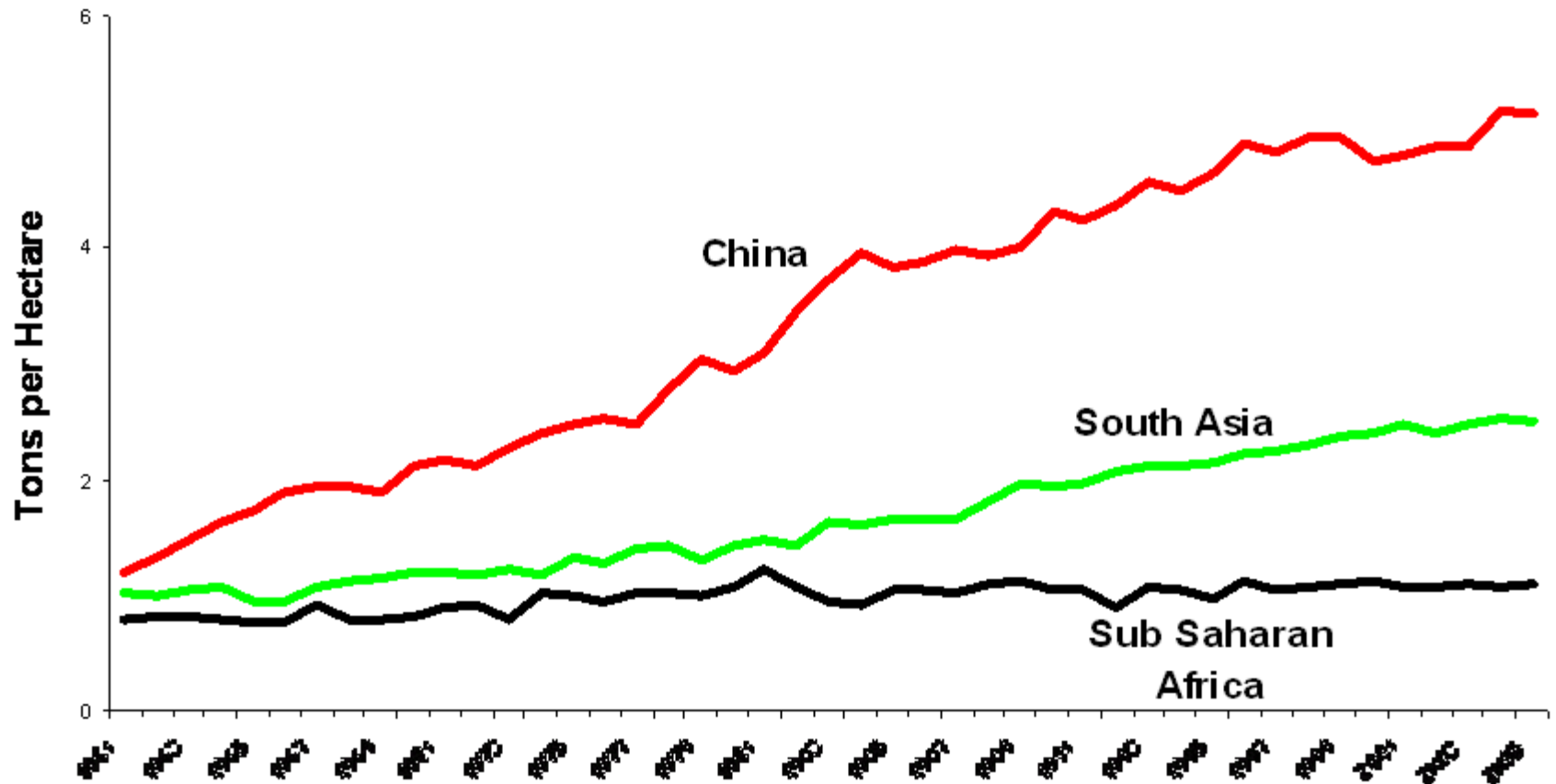
## ETHANOL

- **Maize** 3,500
- **Sugar cane** 6,200
- **Switchgrass** 10,000

## BIODIESEL

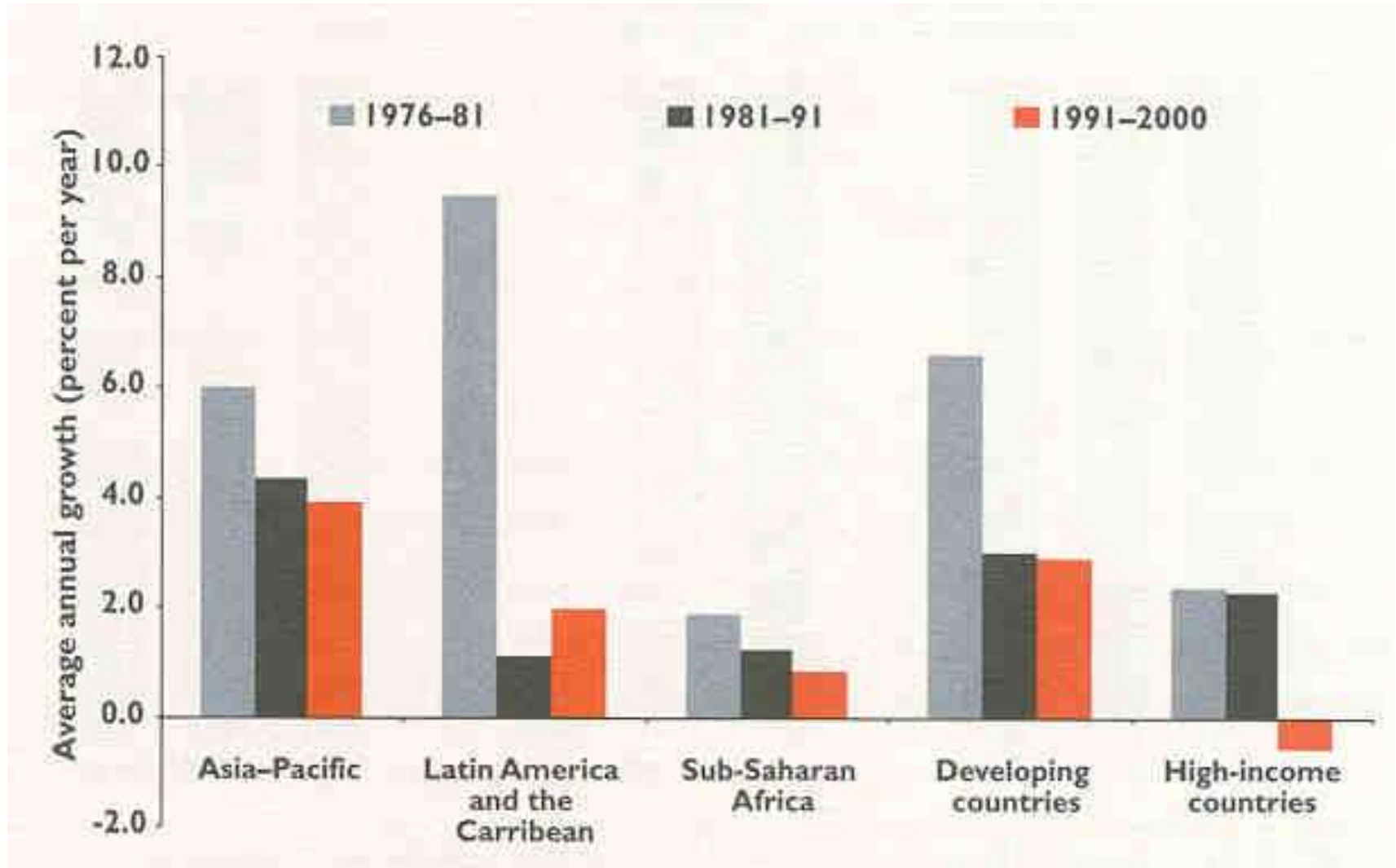
- **Maize** 172
- **Soy** 450
- **Canola** 1,200
- **Jatropha** 1,900
- **Oil palm** 6,000
- **Algae** 90,000

# Average Cereal Yields



(FAO 2006)

# We need to boost Public Agricultural R&D



Source: IFPRI)

# **If food prices are high why can't Developing Country farmers respond?**

- **Lack of inputs**
  - **High costs of fertilisers**
  - **Inappropriate technologies**
  - **Poor land tenure**
  - **Lack of water**
  - **Poor extension**
  - **Variable and unreliable markets**
  - **Poor infrastructure**
  - **etc**
- 
- **But the mix varies from place to place**
  - **We urgently need new diagnostics, country by country, state by state**

# **The Way Forward**

# **Doubly Green Revolution**

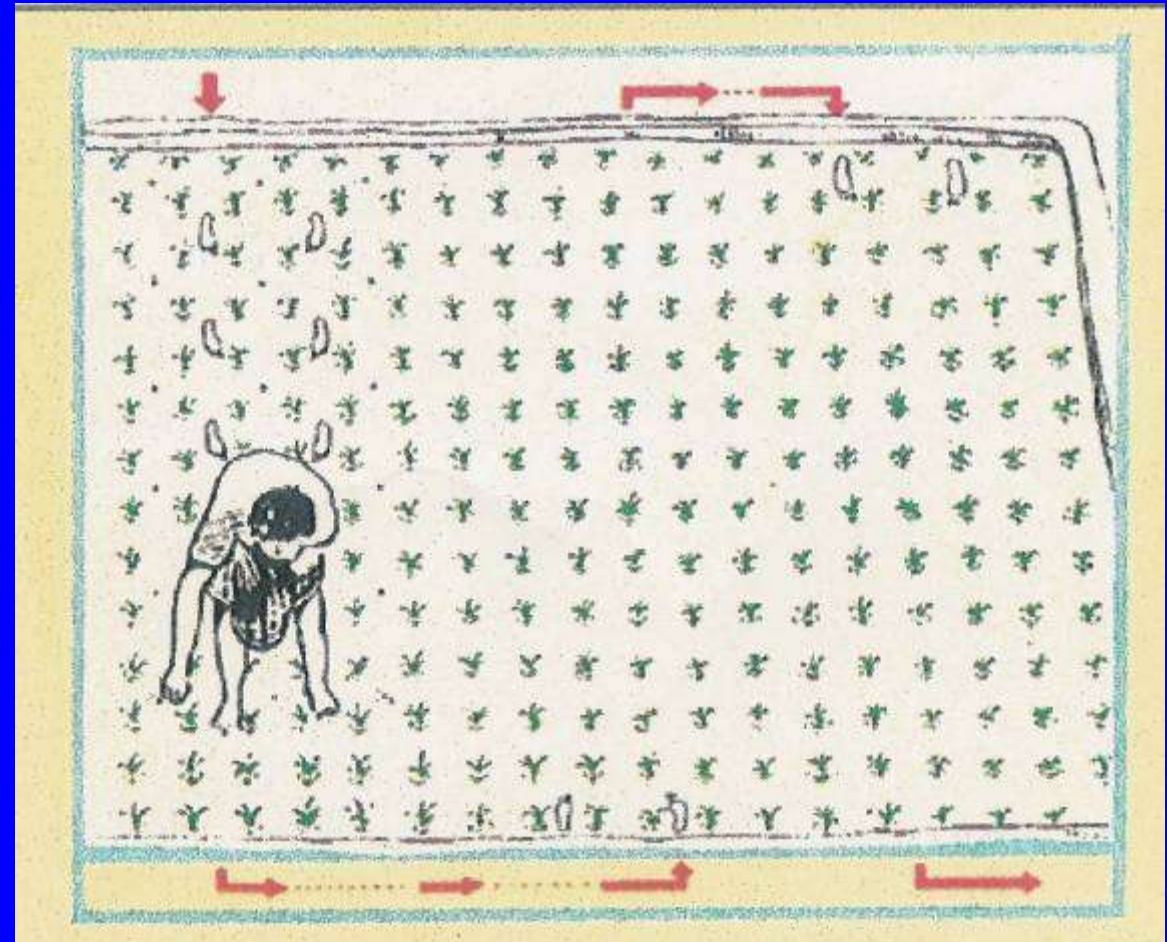
- **The aim**
  - **repeat the success of the Green Revolution**
  - **on a global scale**
  - **in many diverse localities**
- **and be**
  - **equitable**
  - **sustainable**
  - **and environmentally friendly**

# How do we achieve this given current realities?

- **Bio-physical inputs**
  - **Costs of fertilizers, pesticides and water**
- **Ecological/Agronomic technologies**
  - **Skills and labour**
- **Build into the seed**
  - **Controversies over biotechnology**



# Deep Placement of USG briquettes in paddy

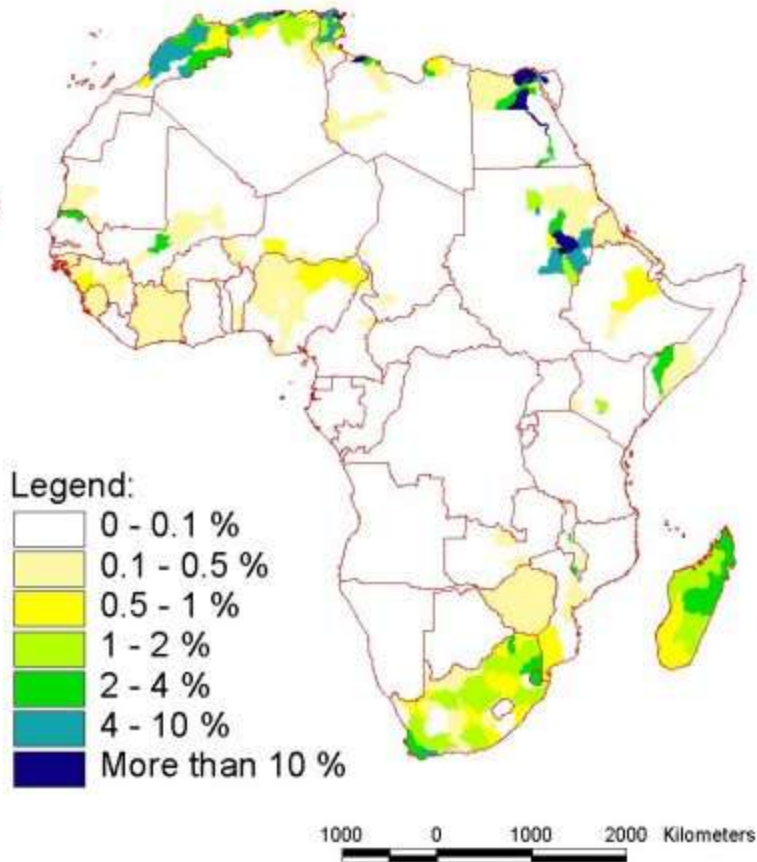


# Controlling Striga



- **2.4 m ha**
- **\$380m loss**
- **Maize resistant to Imazapyr**
- **Coat seed, herbicide kills Striga**
- **BASF, Weismann. CIMMYT, IITA, NARS, NGOs**

## Area under irrigation




**What is the  
real  
potential for  
increased  
large-scale  
irrigation in  
Africa?**



**Treadle pump and drip irrigation – are these the alternatives?**

# **Ecological/ Agronomic Approaches**



Rasike Farm, Chililila WG. MBILI maize-soyabean intercrop providing 1215 kg maize and 545 kg soyabean per ha when conventional intercrops failed. These results indicate that MBILI is a means toward greater food security.



Wamalwa Farm, Siritanyi FFS, Kanduyi. Maize-groundnut intercrop providing 5330 kg maize and 1203 kg groundnut per ha. These results indicate that MBILI can produce significant food surpluses.

# Controlling Striga using Desmodium



# **Building Sustainability into the Seed (or the animal)**

- **Increasing nutrient uptake efficiency**
- **Improving nutritive value**
- **Countering the new pest and disease outbreaks**
- **Increasing drought tolerance**



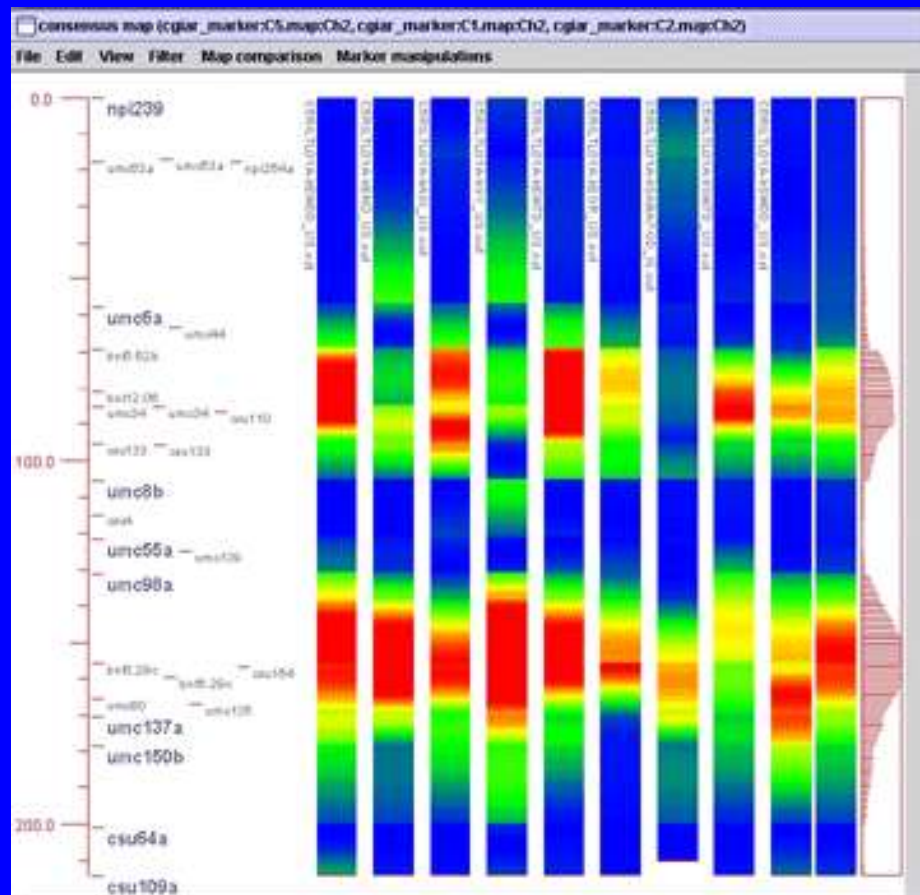
# The New Rices for Africa



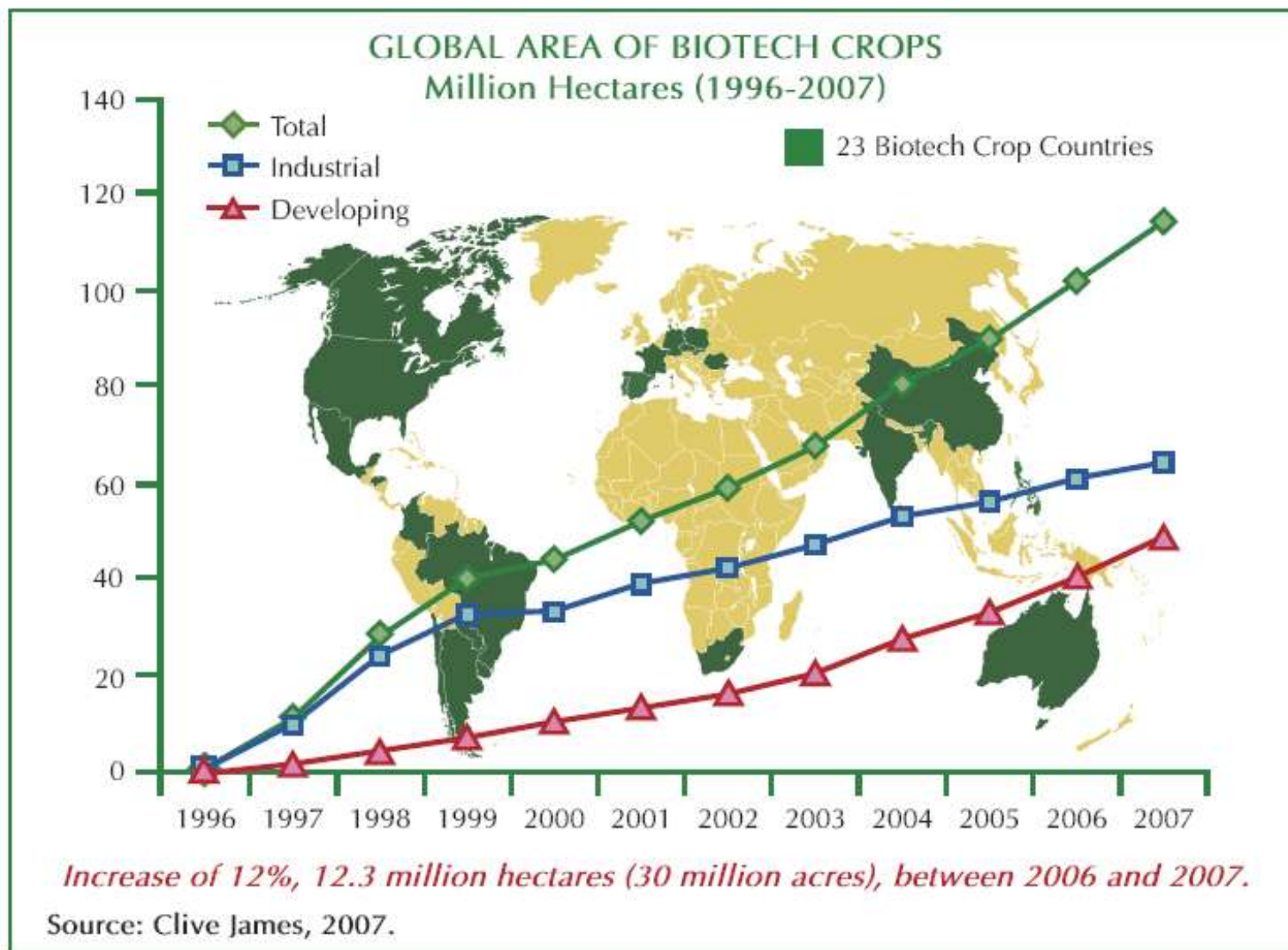
**Monty Jones**  
**2004**

# Marker- Aided Selection

- **Locating and tagging the genes for drought tolerance**



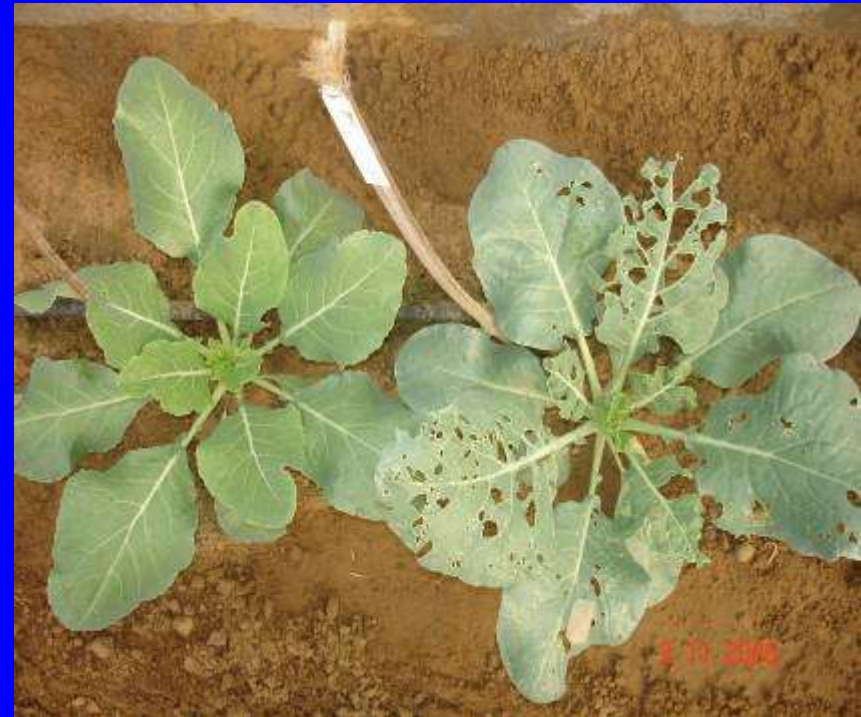
# Recombinant DNA or 'GM' Crops





**Uganda**

# Diamond Back Moth



Source: CIMBAA

# How do we judge an technology is appropriate ?

- Does it work?
- Is it value for money?
- Is it sustainable?
- Is it equitable?
- Are there downsides?
- What is the counterfactual?

**But technologies are never  
enough**

**The context is crucial**

**How do we scale up?**

# **One solution is Layered Interventions**

**e.g. Western Kenya**

- **New hybrid maizes**
- **Agro-dealers**
- **Local fertilisers**
- **Cereal Banks**
- **Markets**
- **Market information**



# Agrodealers



# Output Markets

## Cereal Bank in Western Kenya

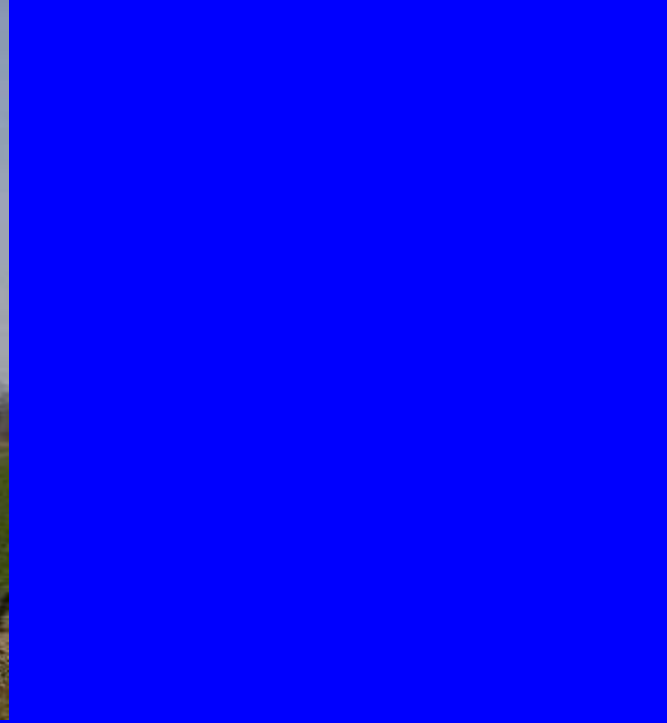


# **We also need to build Regional Markets**

- **World Food Program**
- **Purchase for Progress**
  - **Stable and accessible market for small farmers**
  - **5 year pilot – 350,000 farmers**

# **And to build participation in High-Value Agricultural Markets**

- **IPRI Studies**
  - **Pigs in Vietnam**
  - **Horticulture in China**
- **Higher Household Income for Small Farmers under Contract farming**
  - **More productive use of labour and land**
  - **Reduction in production and market risks**
  - **Reduction in transaction costs for inputs and outputs**



**Loess Plateau**

**China**





**Loess Plateau, China**



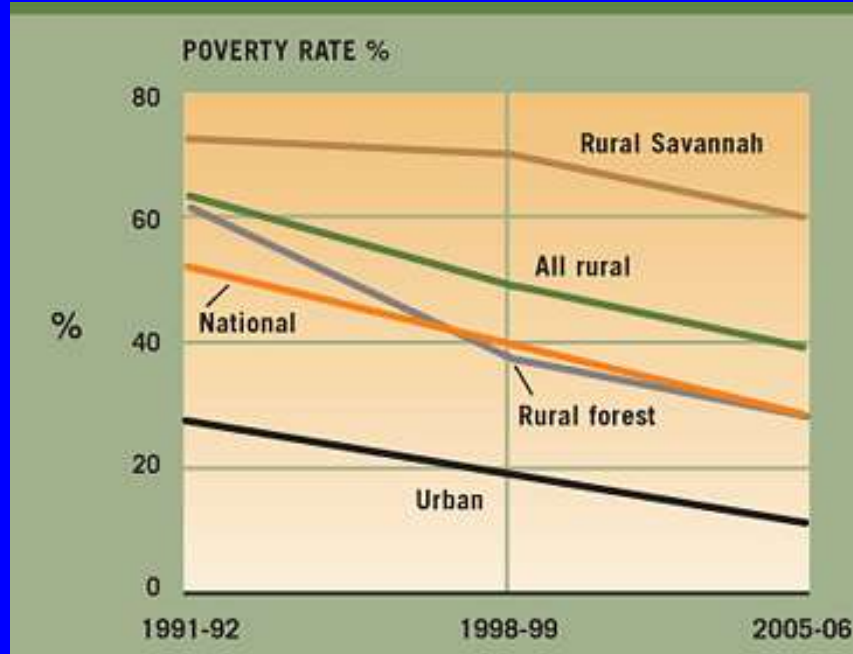
**Rwanda**

**Bourbon Coffee**

**Getting the  
Quality Control  
right**



# Ghana's Success Story



- **MDG 1 achieved**
- **Malnourished - 5.8m in 1993 to 2.7 m in 2003.**
- **Declines in % underweight children and mortality**
- **Strong agricultural growth since 80s**
- **25% increase due to area expansion**
- **Maize yield up by 36%, cassava by 50%**
- **New maize, yam, rice and cassava varieties**
- **A pest resistant cassava.**
- **Strong growth in smallholder cocoa & pineapples**
- **Market liberalisation**
- **New rural infrastructure**

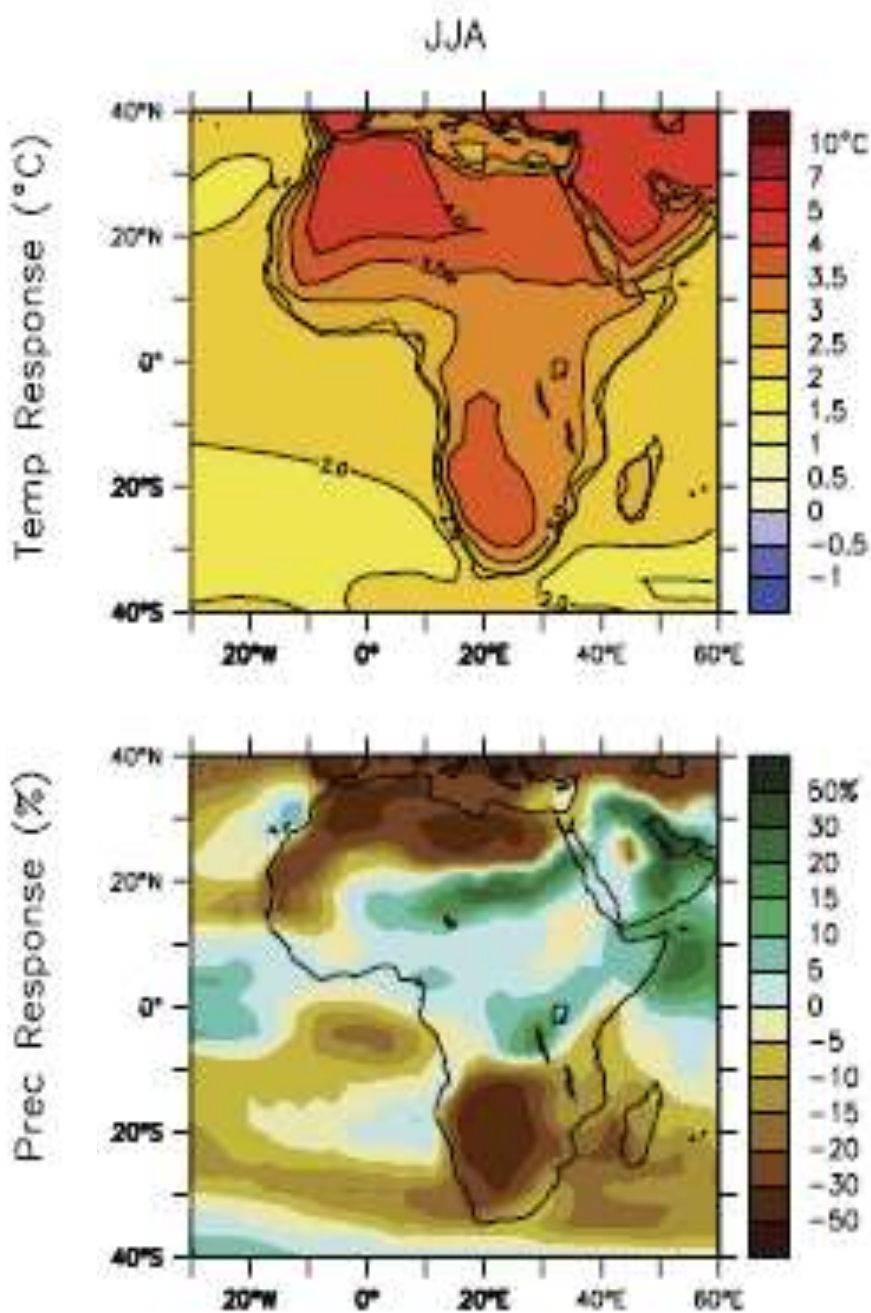
Sources: Development Outreach, October, 08; Coulombe & Wodon, World Bank; Irish Hunger Report



# All this is threatened by Climate Change

- Higher temperatures
- **Greater & more intense rainfall**
- Greater droughts
- **River bank erosion**
- Rising sea levels
- **More intense cyclones**
- Salt water incursions

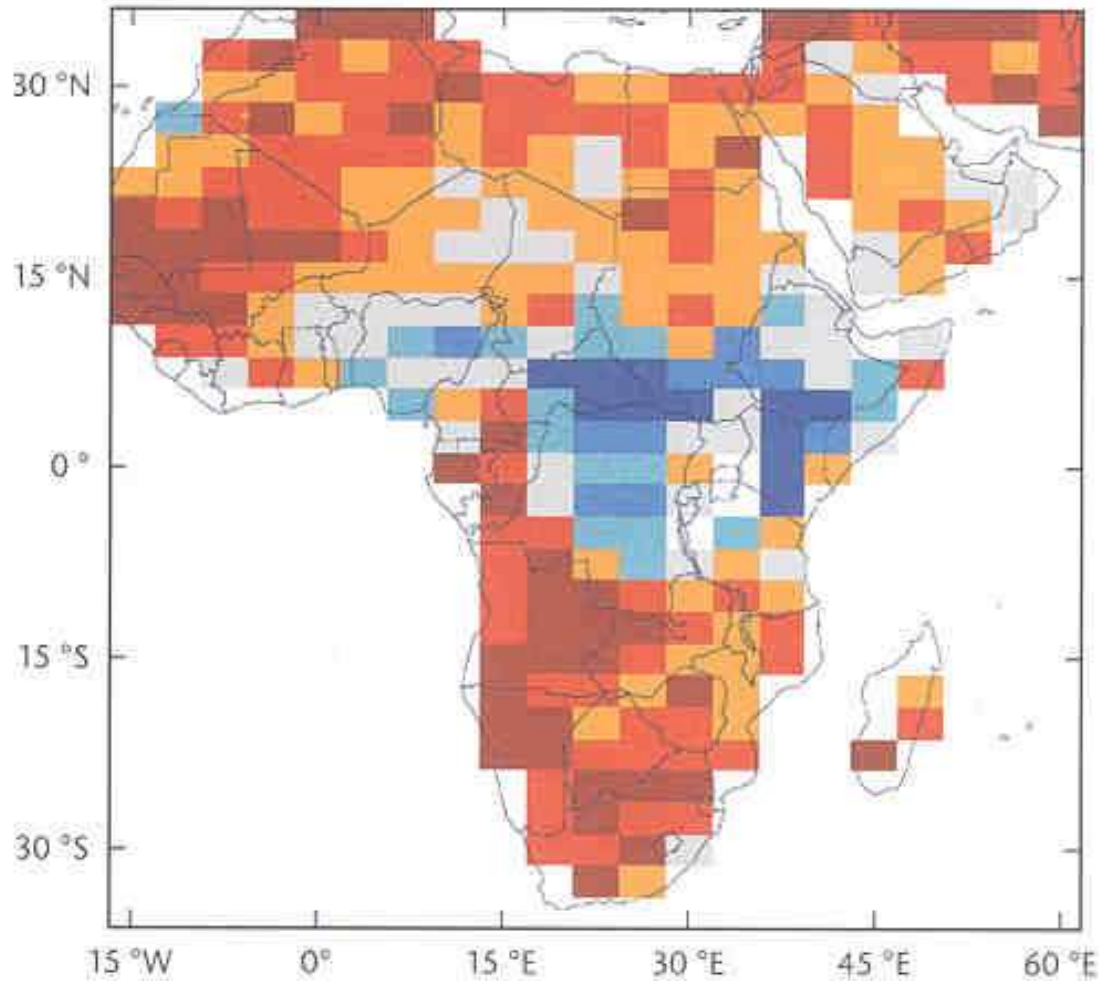




Temperature  
and rainfall  
projections,  
1980 to 1999  
versus 2080 to  
2099

scenario A1B

# Drought in Africa between now and 2090



**Red, Orange** =  
More prone to  
drought

**Blue** =  
Wetter and less  
prone to  
drought

# Combating the stress of Increasing Drought

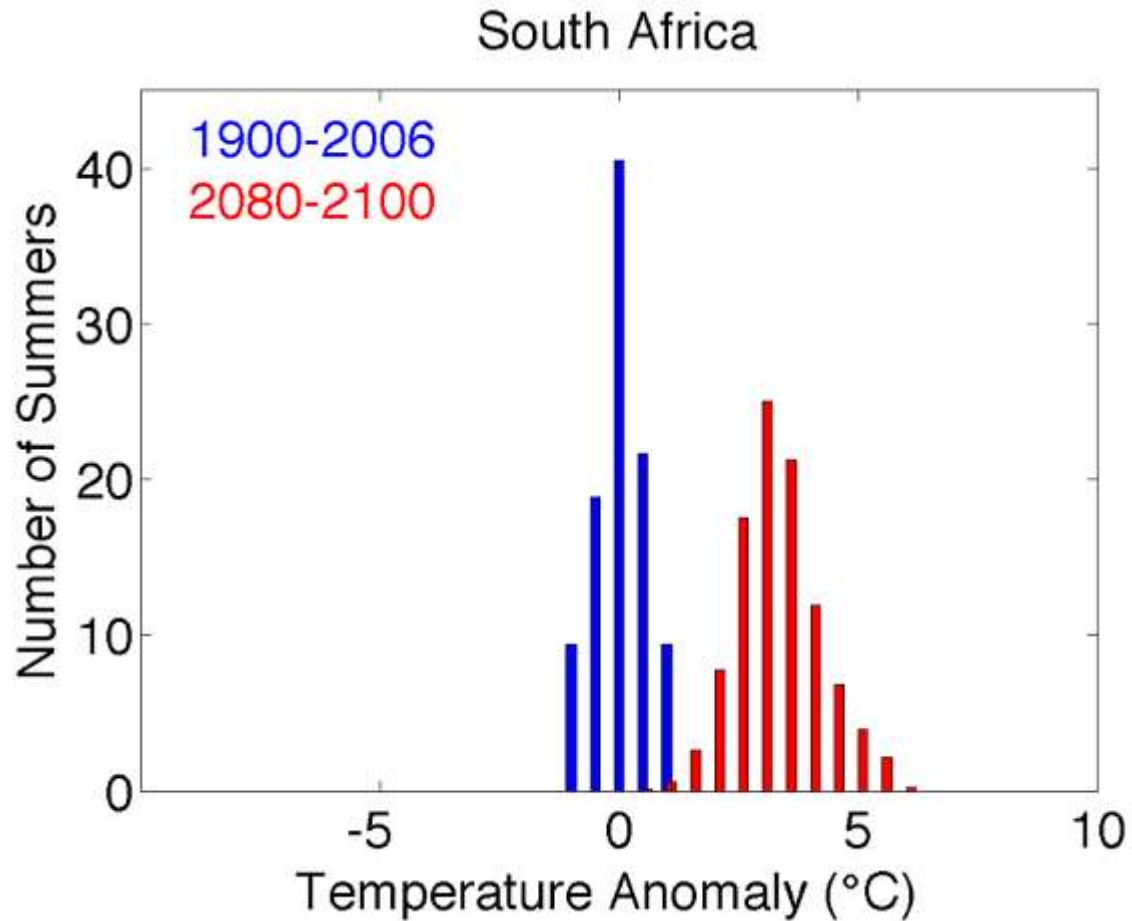
- **Drought tolerant varieties and breeds**
- **Drought tolerant cropping and farming systems**
- **Small-scale sustainable water supplies**

# Crop Biodiversity



**The Seed Vault at Svalbard  
Global Crop Diversity Trust**

# Separate Niches



# Conservation Farming in Zimbabwe





**Ploughed**



**3 years  
Minimum Tillage**



# Adaptation measures in Ningxia

## ■ Drought:

### ■ Farmer level

- Plastic film
- Change to plant other crops
- Cover small stone
- Terrace
- Saving water irrigation
- Water cellar
- .....



**In many places droughts  
and floods will occur with  
greater frequency and  
intensity**

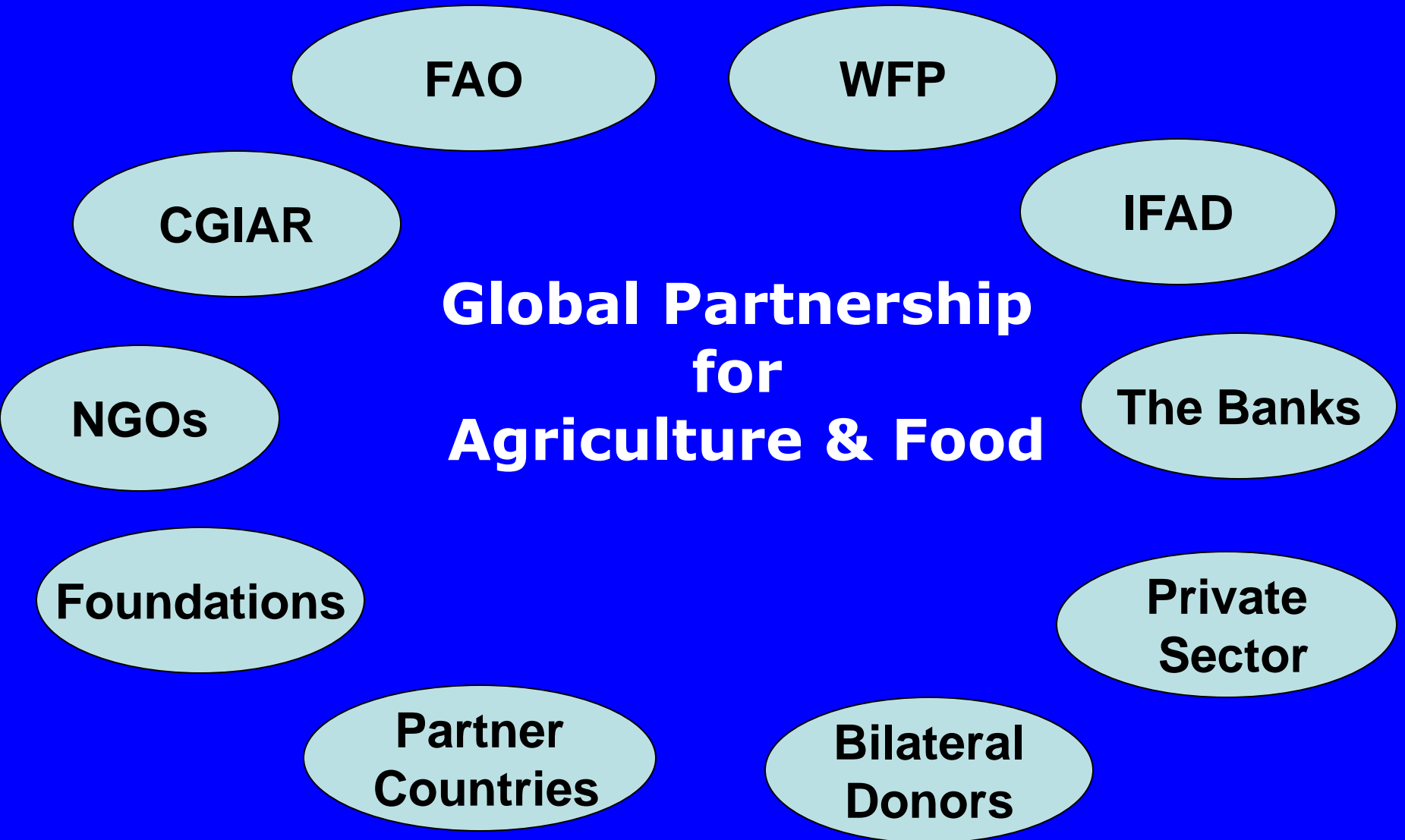
**How do we build  
Resilience?**







# The International Architecture



# The Lewes Pound

