AGRICULTURE FOR IMPACT

Imperial College London

# ‘A Doubly Green Revolution for the 21st Century’

## Tropentag 2011: Development on the Margin
## Bonn, 5-7 October 2011

**Gordon Conway,**
**Professor of International Development, Imperial College**

# We Face Three Interconnected Challenges

**About 1 billion people,**
**or 1 in 6 of the world's population, are hungry**

**We have to increase food production by 70-100% by 2050**

**The food price spikes of 2007/08 and 2010/11 will most likely be repeated.**

# The Ongoing Food Price Spikes

# Food Riots


European Photo Agency: Financial Times

# Underlying the spikes is a chronic crisis which is getting worse

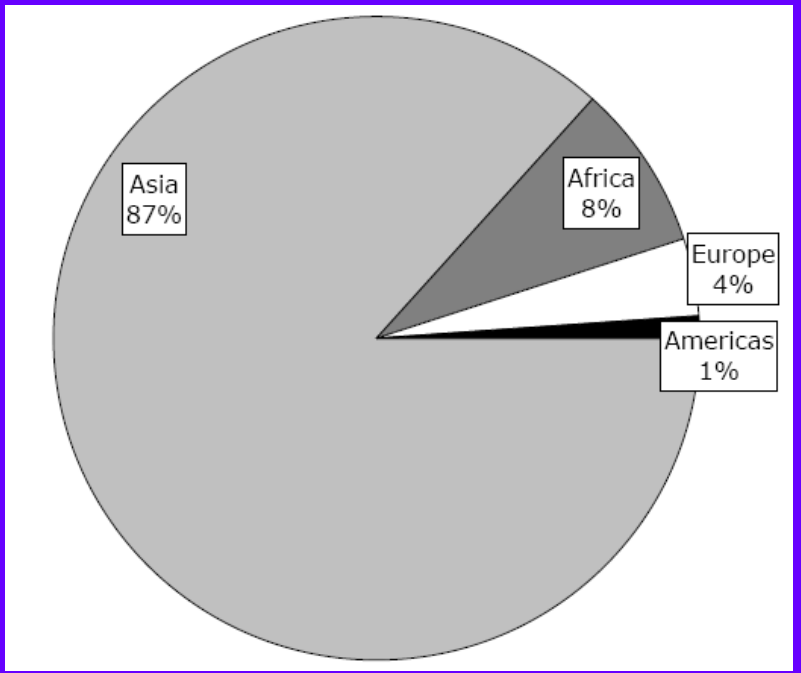
- The Drivers
  - Rising populations
  - Rising per capita incomes
  - Growing demand for livestock products
  - Rising fuel and fertiliser prices
  - Growing demand for biofuels
  - Increasing water and land scarcity
  - Impact of climate change
  - Slowing of productivity increases

# Who are the marginalised?

**'To be marginalized is to be placed in the margins, and thus excluded from the privilege and power found at the centre'**

**Smallholders - under 2 ha**

- **400 – 500 million smallholders**
- **2 billion people**
- **33 million in Africa**
- **80% of farms in Africa**

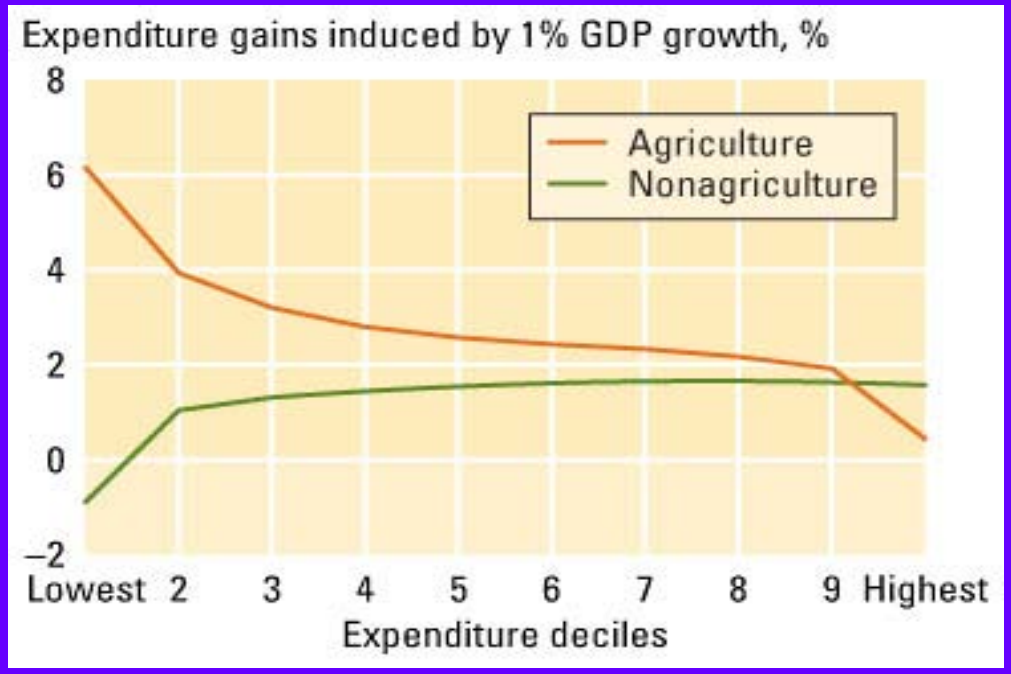


# In Sub-Saharan Africa

- 240 million people chronically hungry
- 380 million people live on less than $1.25 a day.
- 80 million small farms produce 80% of agricultural goods.
- In a number of small countries, agriculture represents 80% or more of export earnings.
- Women 60-80% of the labour used to produce food.
- 25% Africans live in water-stressed countries.
- Only 4% of African cultivated land is irrigated,
- 30-50 % women do not have access to modern family planning methods.

# The Mulitiplier Effect of Agriculture

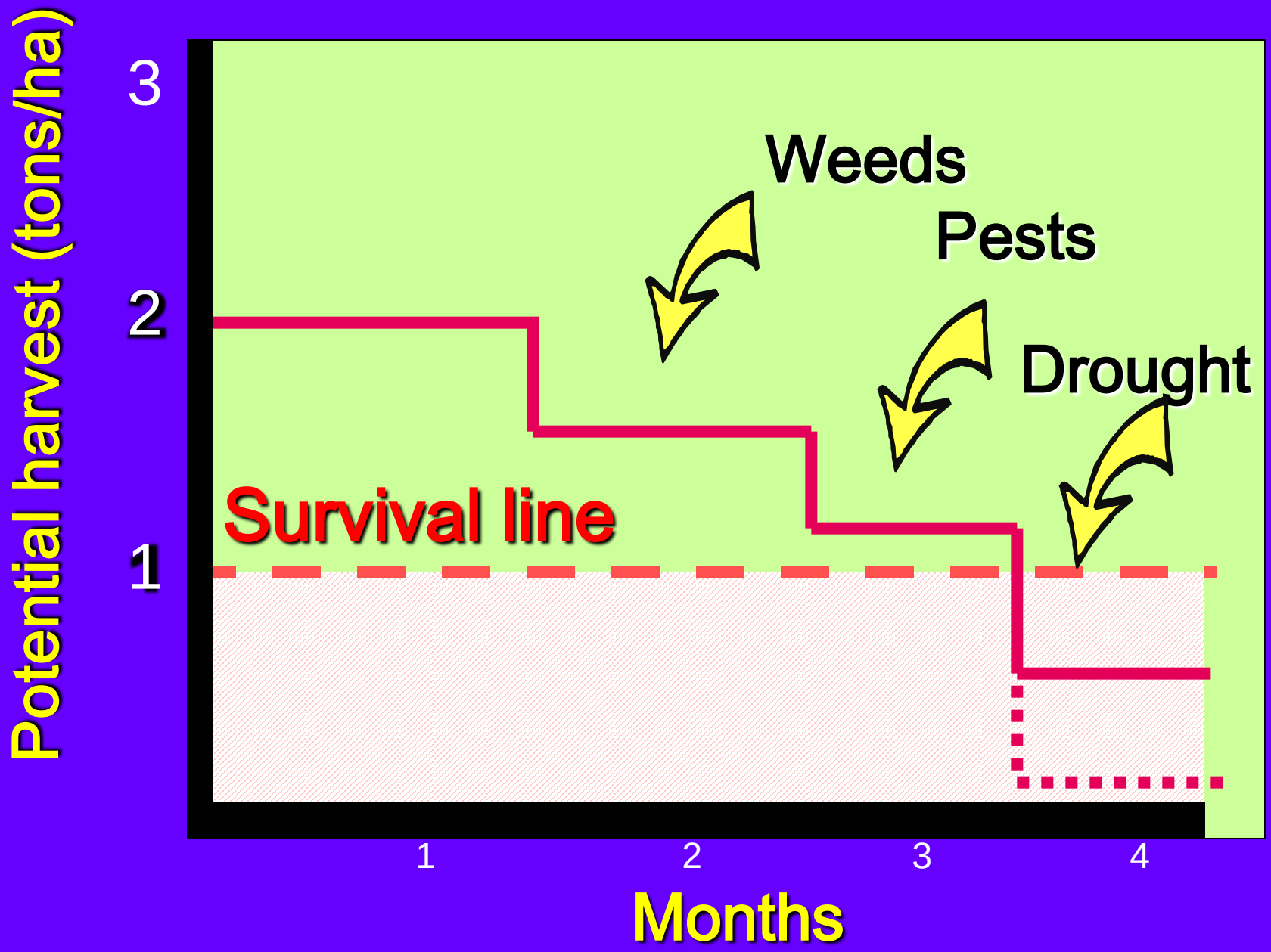
**A 1% gain in GDP from agriculture will generate a 6% increase in overall expenditure of the poorest 10% of the population**



Mrs. Namarunda

A single mother farming a hillside in western Kenya

# An Insecure Farm



# 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

# Sustainable Intensification

- **More with Less**
- **Increased yields but with minimal negative impact on the environment, and without using more land for cultivation.**
- **Greater productivity but smaller footprint**
  - **Land, water , carbon and other GHGs**

**We need appropriate interventions**

# How do we judge an intervention is appropriate ?

- Does it work?
- Does it add significant value?
- Is it resilient?
- Is it equitable?
- Are there downsides?
- What is the counterfactual?

# Appropriate Technologies

- Traditional
- Intermediate
- Conventional
- New Platform Technologies

# A Javanese Home Garden

**Treadle pump and drip irrigation**

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.

# Conventional Technologies

but more precise

# Microdosing in Niger

# Controlling Striga

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

# New Platform Technologies

**Biotechnologies**

**Nanotechnologies**

**Information and Communication Technologies**

# The New Rices for Africa

Monty Jones
2004


Uganda

# GM Bananas resistant to wilt in Uganda

- $500 million losses a year in Uganda
- Academia Sinica provided sweet potato gene
- Successfully transferring to bananas in Uganda government laboratory

# Part of the answer lies in Appropriate Science and Technology

**But there are no silver bullets**

**Must be combined with an enabling environment and appropriate governance**

# An Enabling Environment consists of the sum total of:

- the macroeconomic policies that favour markets and trade,
- the provision of inputs
- related physical infrastructure (such as roads and irrigation) and
- social infrastructure (education, research etc),
- and accompanying institutions and regulations.
- etcetera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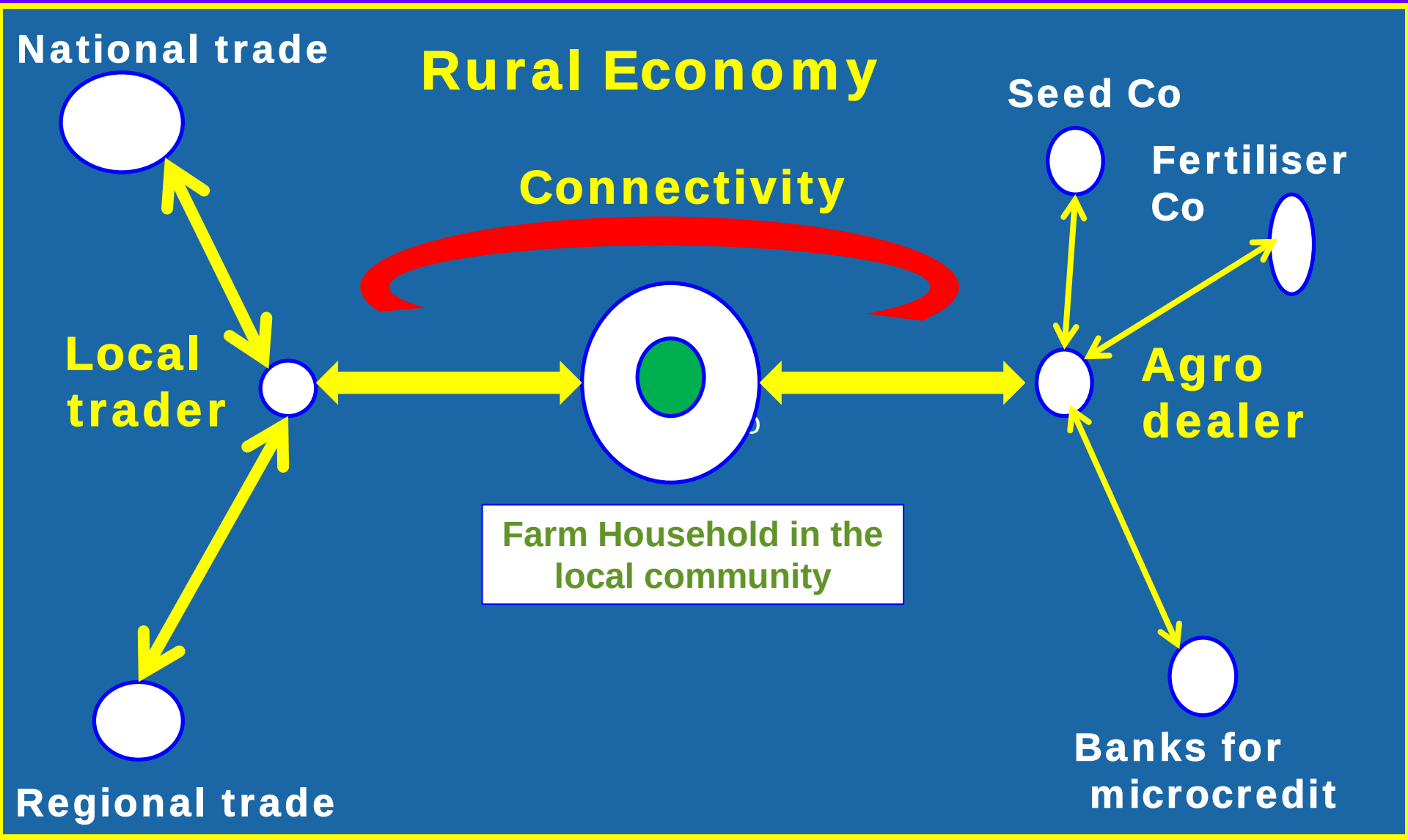
# An Enabling Environment




Model of Alliance for a Green Revolution for Africa (AGRA)

# Governance for Enabling Environments

- Appropriate macroeconomic policies
- Significant investment in infrastructure, research, extension, education
- Security of tenure
- Minimal corruption
- Efficient and fair markets
- Supportive environment for SMEs

# We also need to cope with Climate Change

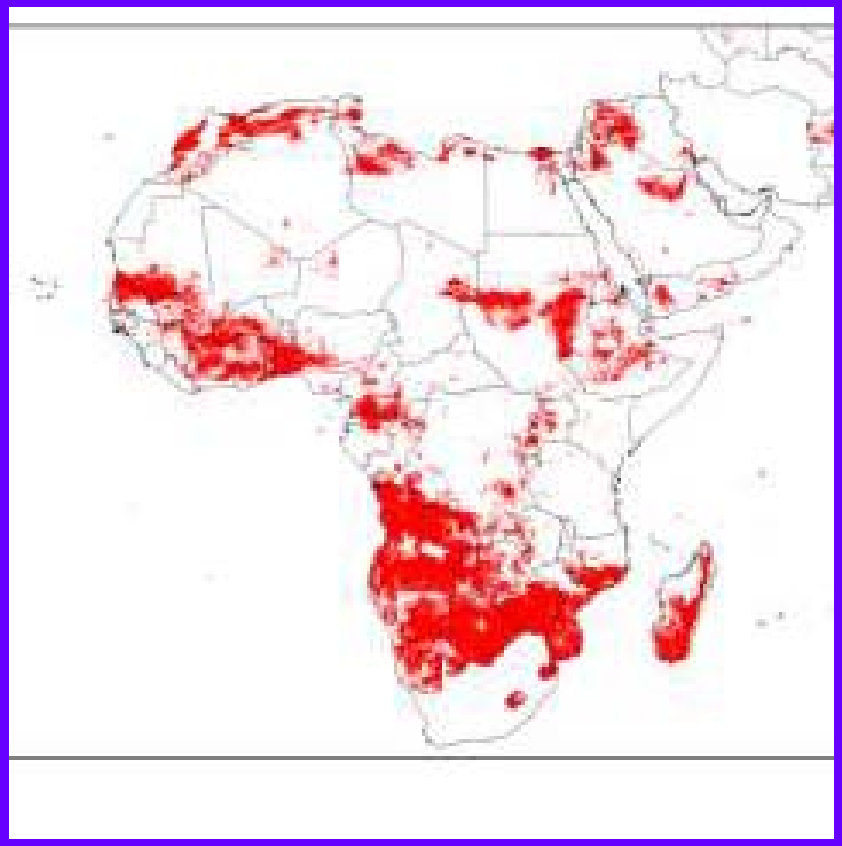
# All this progress is threatened by Climate Change

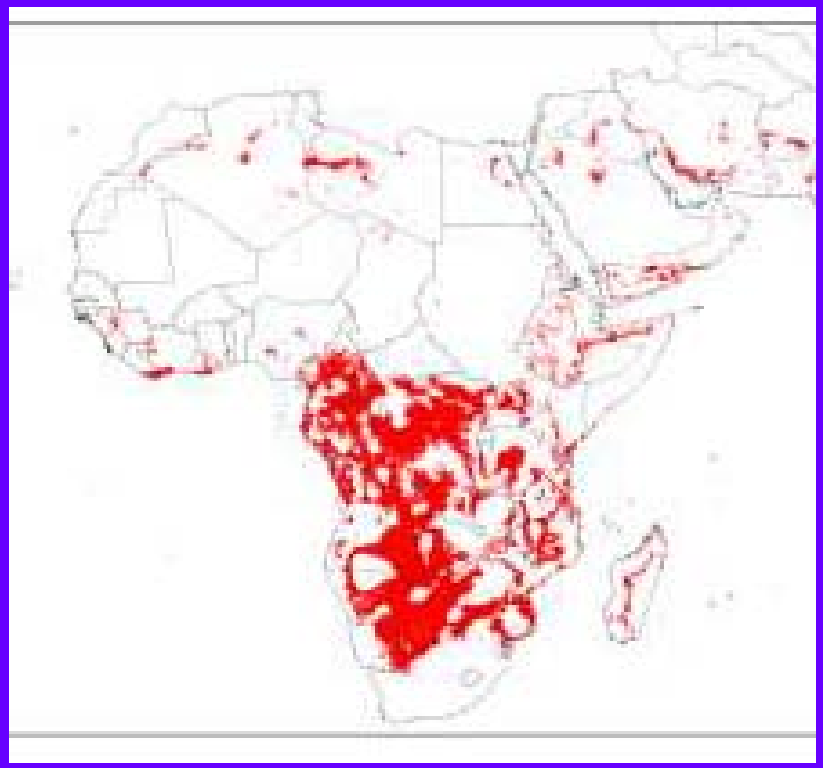
- Higher temperatures
- Greater & more intense rainfall
- Greater droughts
- River bank erosion
- Rising sea levels
- More intense cyclones
- Salt water incursions

**More then 5% reduction in length of growing period**

**Ave. Annual Max Temp > $30^0$C**

By 2050





Ericksen P, Thornton P, Notenbaert A, Cramer L, Jones P, Herrero M. 2011. Mapping hotspots of climate change and food insecurity in the global tropics. CCAFS Report no. 5 (Advance Copy). CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org.

# Options to Combat Drought

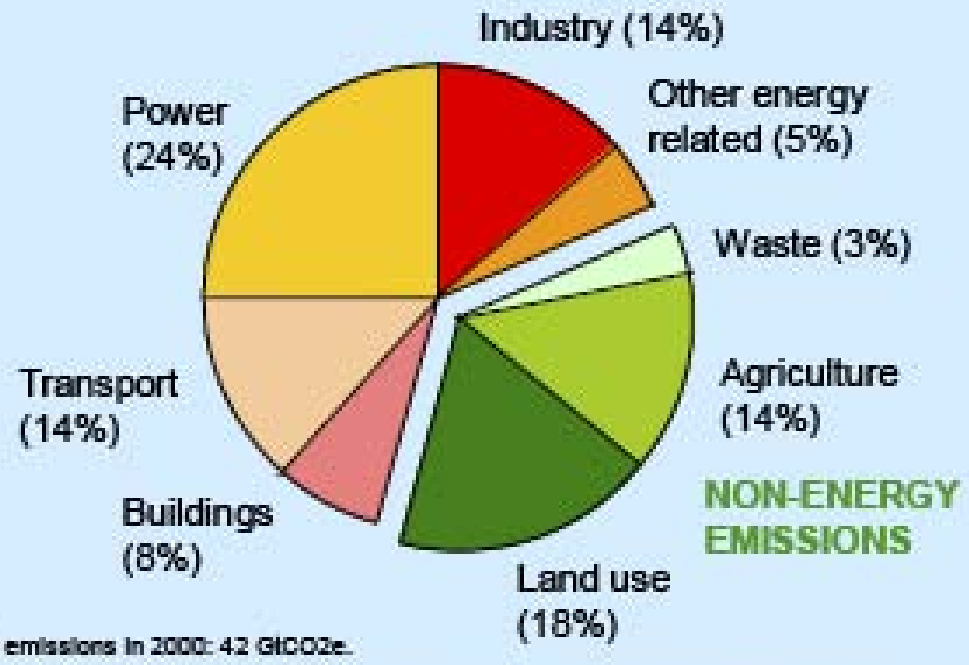
- **Drought tolerant varieties and breeds**
- **Drought resilient cropping and farming systems**
- **Drought resilient livelihoods**
- **Small-scale sustainable water supplies**

# Chaperone Genes to the Rescue

- Genes from Bacterial RNA
- Confer tolerance of stress – cold, heat and water
- Allow plants to rapidly recover from stress
- No yield penalty when stress free
- No water 10-14 days before flowering
  - 50% reduction in growth compared to well- watered
  - 12% - 24% increase in growth for those with chaperone gene

# Agriculture as a Mitigator

Figure 7.1 GHG emissions in 2000, by source[6]

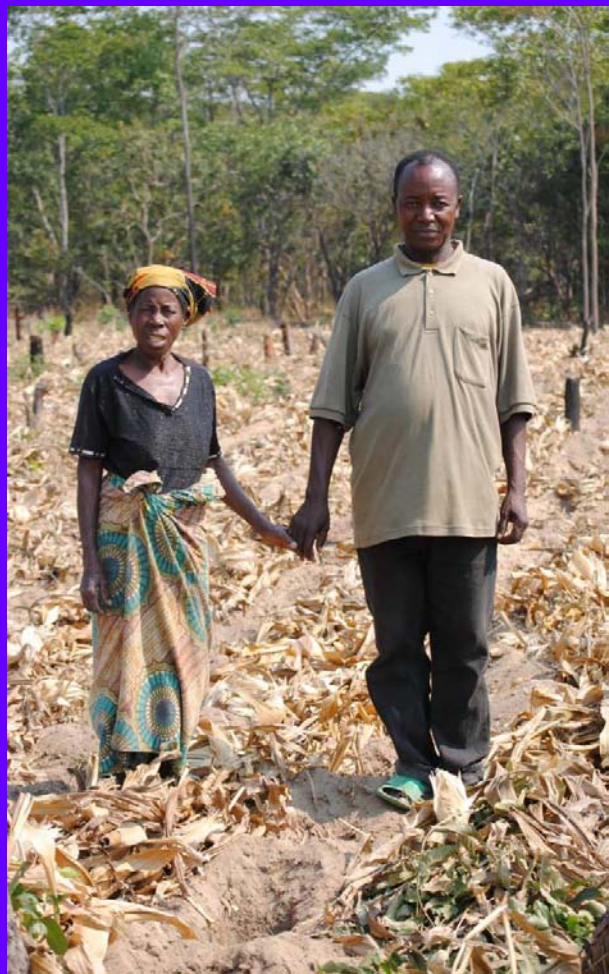



Total emissions in 2000: 42 GtCO2e.

Energy emissions are mostly $CO_2$ (some non-$CO_2$ in industry and other energy related).
Non-energy emissions are $CO_2$ (land use) and non-$CO_2$ (agriculture and waste).

Source: WRI (2006)

# Win-win Solutions
# Conservation Farming in Zambia




Maize farming in a *Faidherbia* agroforest in Mbarali District, Southern Highlands, Tanzania. 2008
Photo: Saidi Mkomwa

# How do we build Resilient Livelihoods?

# The Virtuous Circle

- **As agriculture develops – greater yields and production of subsistence and cash crops – smallholders become more prosperous. The landless also benefit through wage labour. Chronic hunger decreases.**

- **The rural economy also grows – through the creation of small rural businesses - providing more employment and improved rural facilities, especially schools and health clinics. Roads and markets develop. The rural economy connects to the urban economy and to the growing industrial sector.**

- **Free trade provides opportunities for greater imports and exports. High value agricultural exports accelerate agricultural development, further intensifying the virtuous circle.**

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# Thank you

**For more info on Ag4Impact, go to:**
**www.imperial.ac.uk/africanagriculturaldevelopment**

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