Looking Back, Looking Forward

World Food Prize, Symposium, Des Moines Iowa, October 19 2006

Gordon Conway
Chief Scientist, Department for International Development, UK
Professor of International Development, Imperial College

The Green Revolution was one of the most successful technologies of the 21st century

Norman Borlaug

M.S. Swaminathan

Vo Tong Xuan

Yuan Longpin

First, A Little History

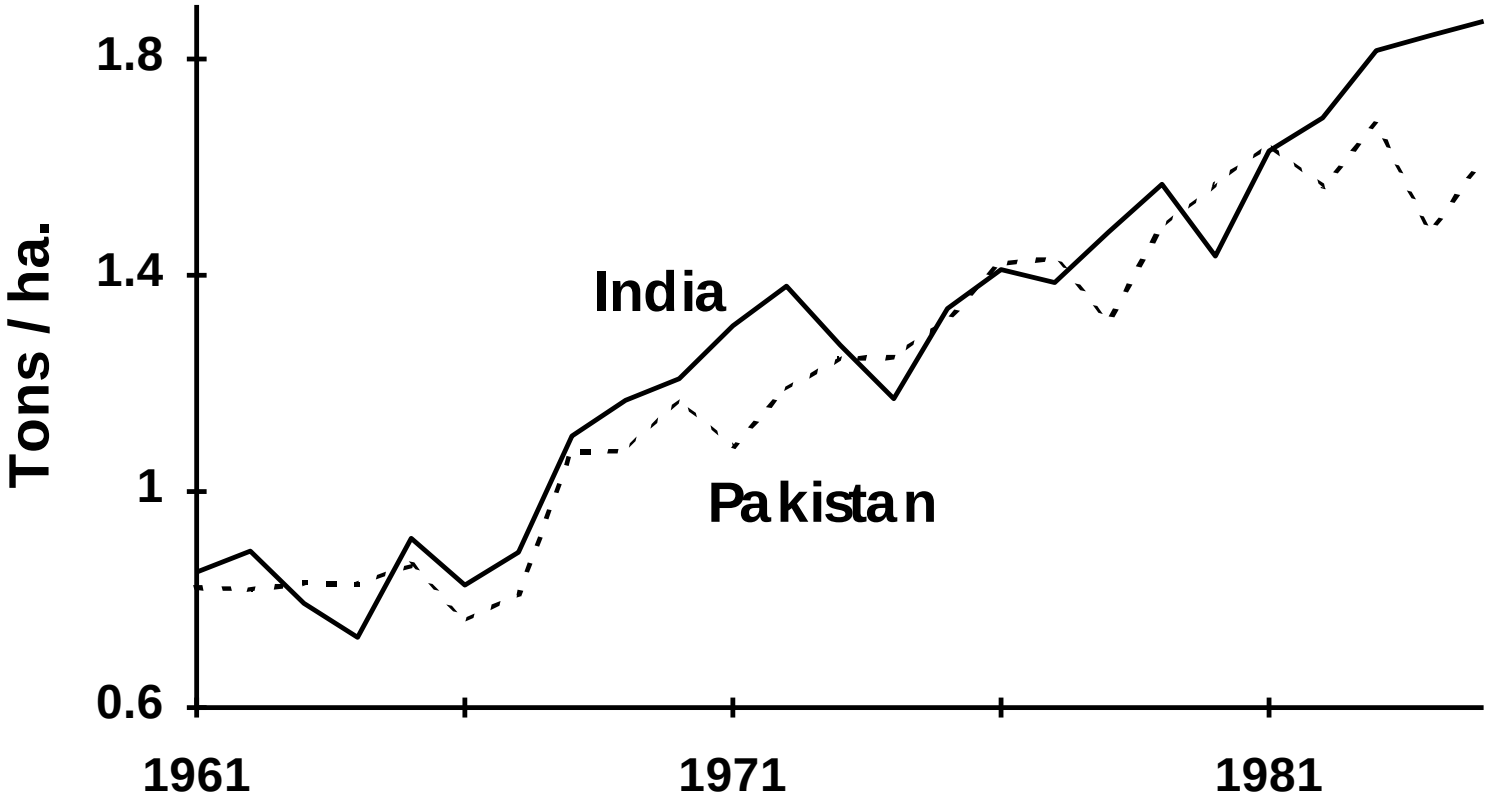
GR – The Salients (1)

- 1943 A joint venture, the Office of Special Studies - the Mexican Ministry of Agriculture and the Rockefeller Foundation.
  - George Harrar, Edwin Wellhausen, Norman Borlaug and William Colwell.
  - Maize, wheat and beans.
- Maize
  - 1948 Synthetic maizes. 1960 a third of the crop
- Wheats
  - 1949 Rust resistant vars., 1956 self sufficiency
  - Lodging

GR The Salients (2)

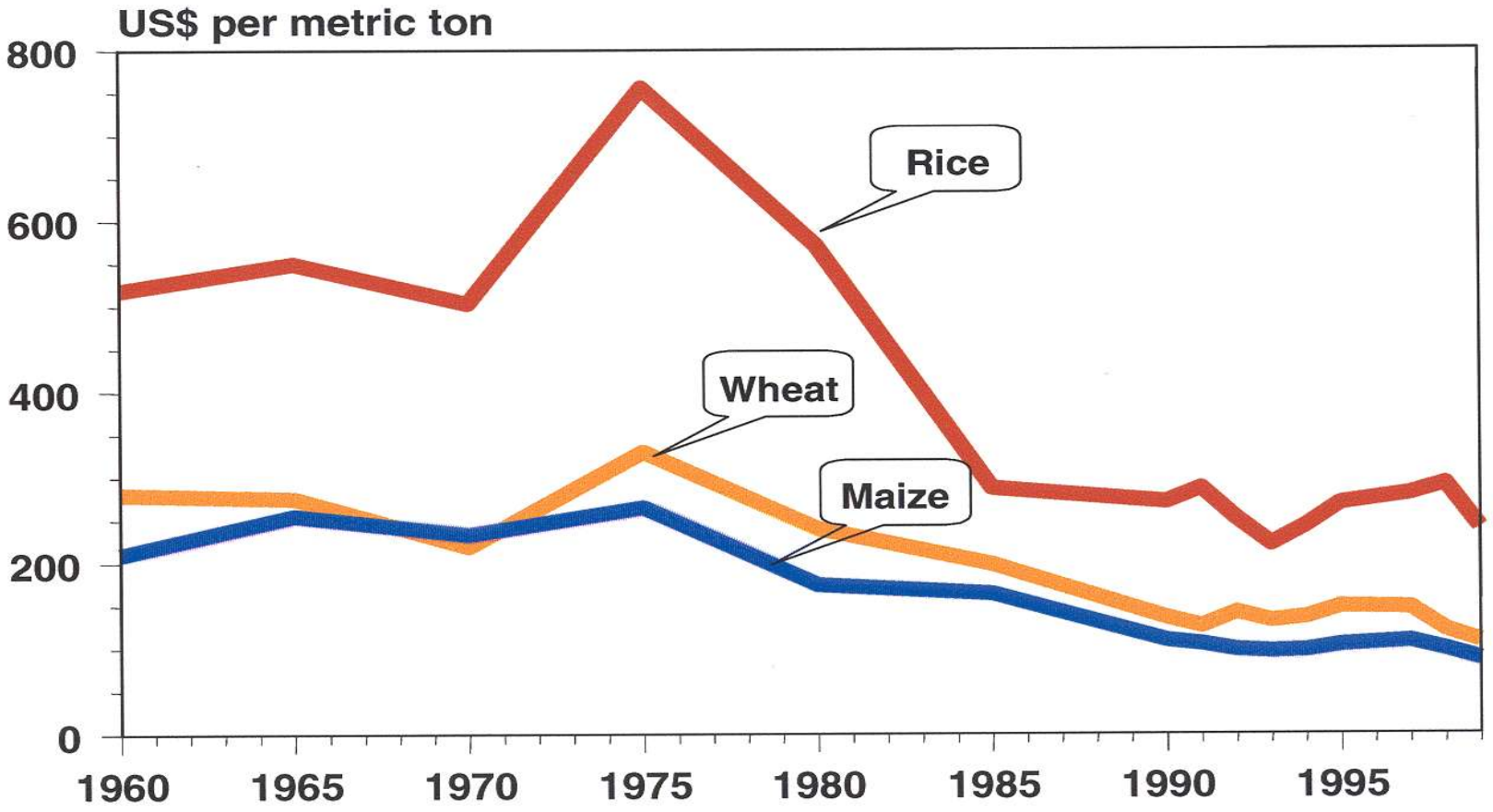
- Wheat
  - 1953 Short-strawed Norin 10 from Japan
  - 1966 7 tons/ha, 1985 5.5 m tons
- Rice
  - 1961 IRRI in Philippines
  - Dee-geo-woo-gen, a short, stiff-strawed variety with a single recessive gene for dwarfing.
  - 1966 IR8 the "miracle rice".
  - China -1959 similar to IR8 - Guang-chai-ai.

Growth in average wheat yields during the Green Revolution



FAO

Real Cereal Prices (1990 US$)



Source: World Bank (2000)

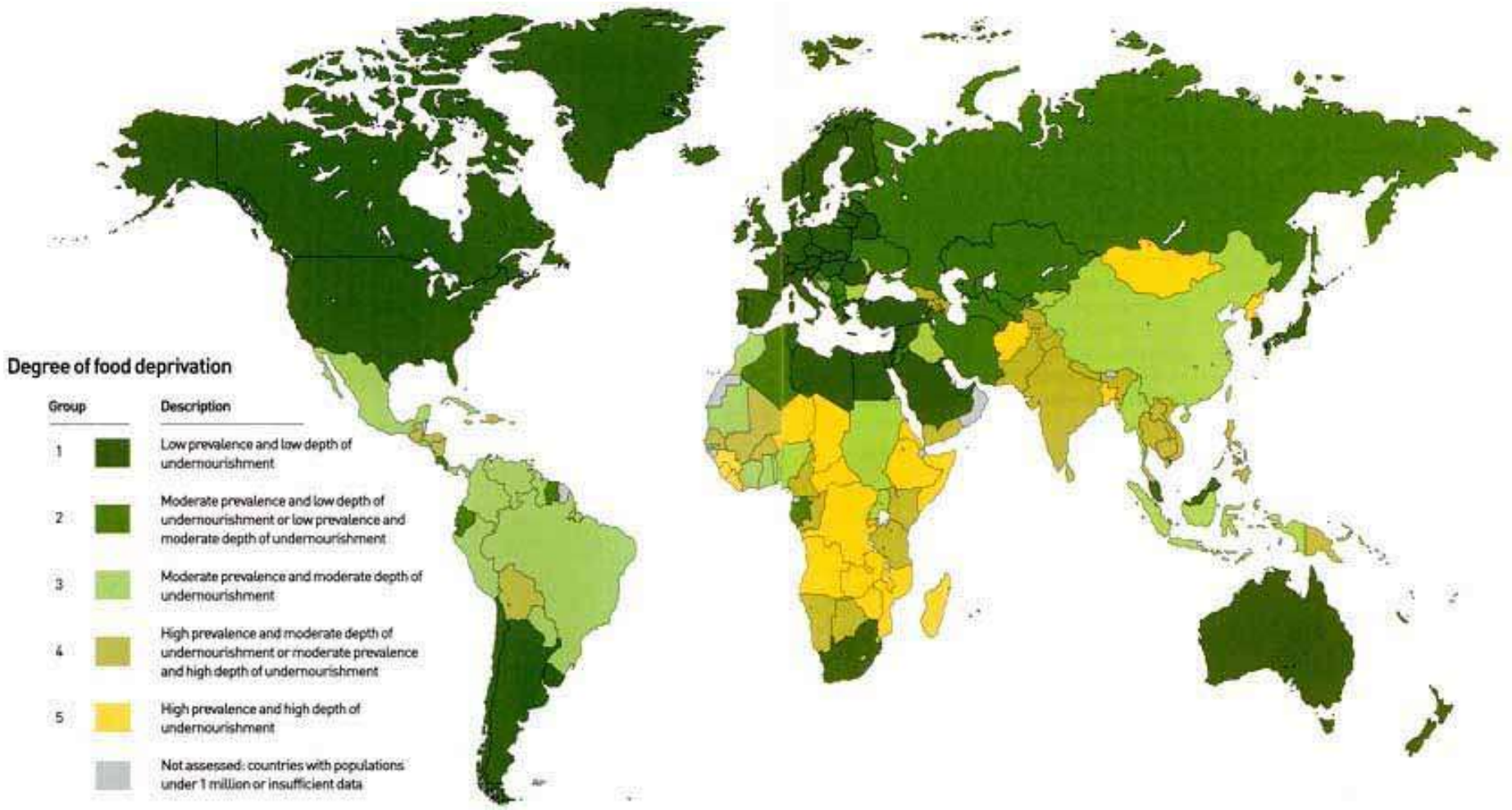
The Limitations

- Focused on 'ideal' environments
- Heavy reliance on synthetic pesticides
- Not all the poor benefited
- Passed Africa by

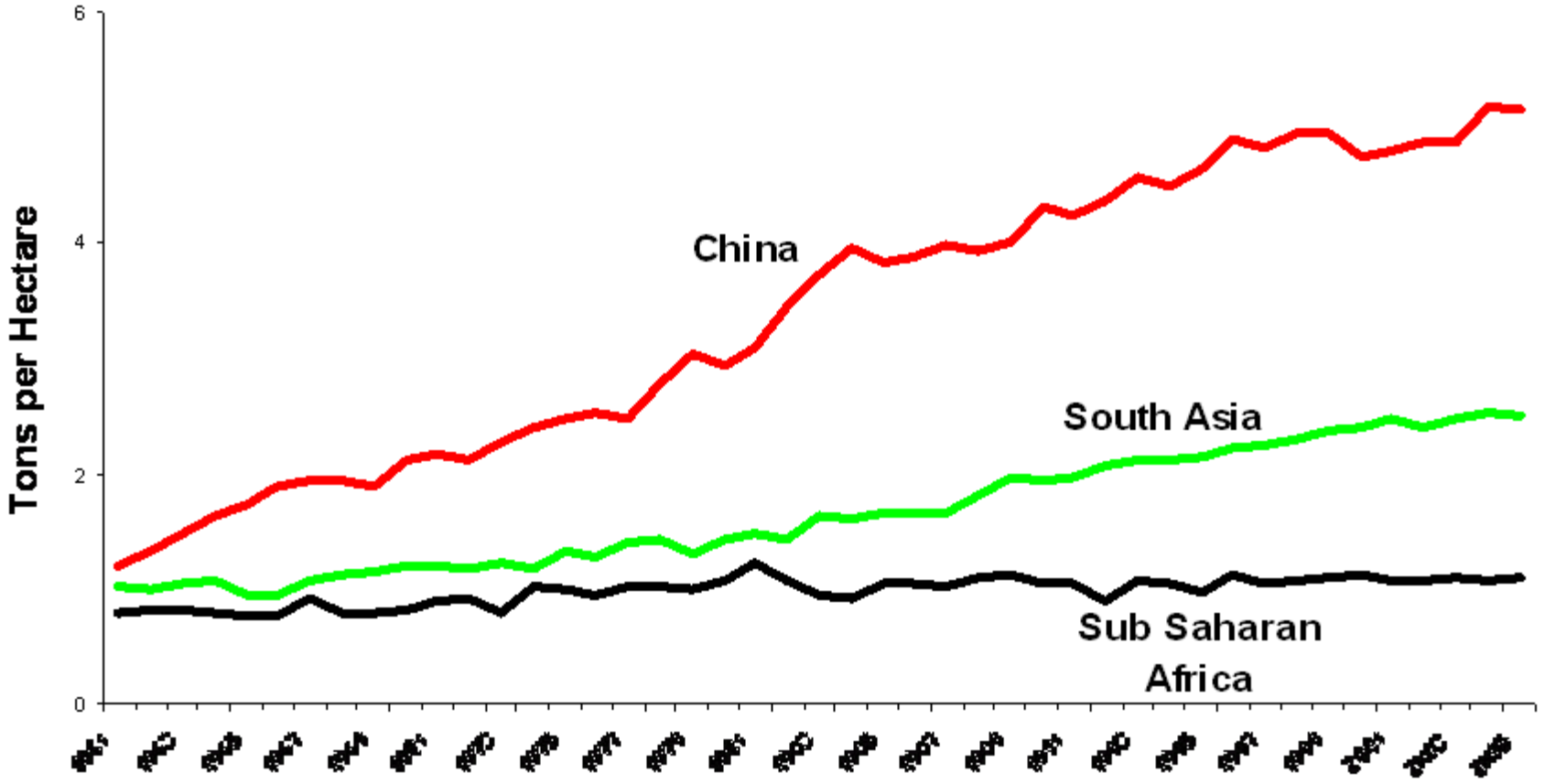
Today there are:

- **Over 800 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**

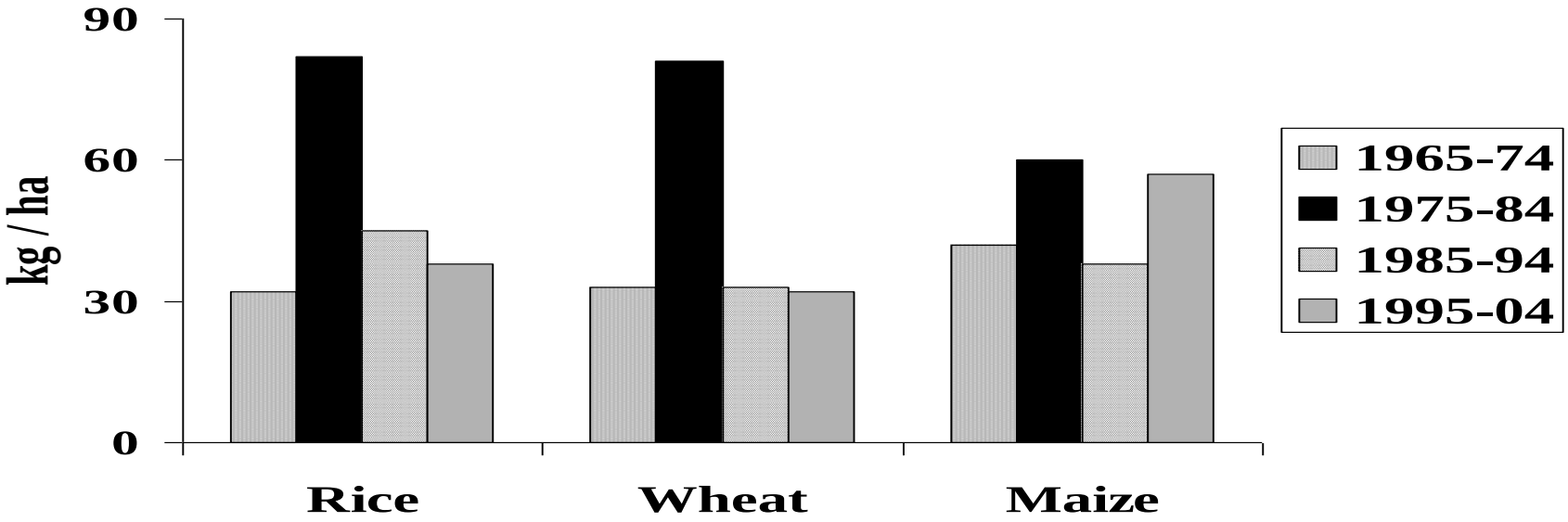
Global Food Deprivation



Average Cereal Yields (FAO 2006)



Average annual increase in developing country cereal yields (FAO, 2006).

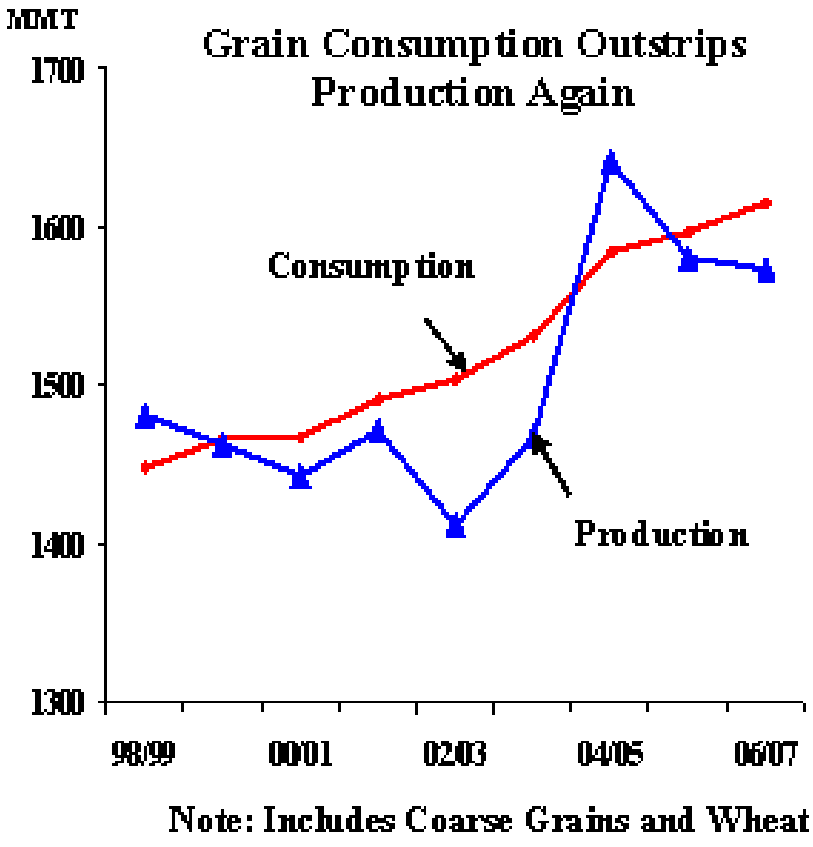


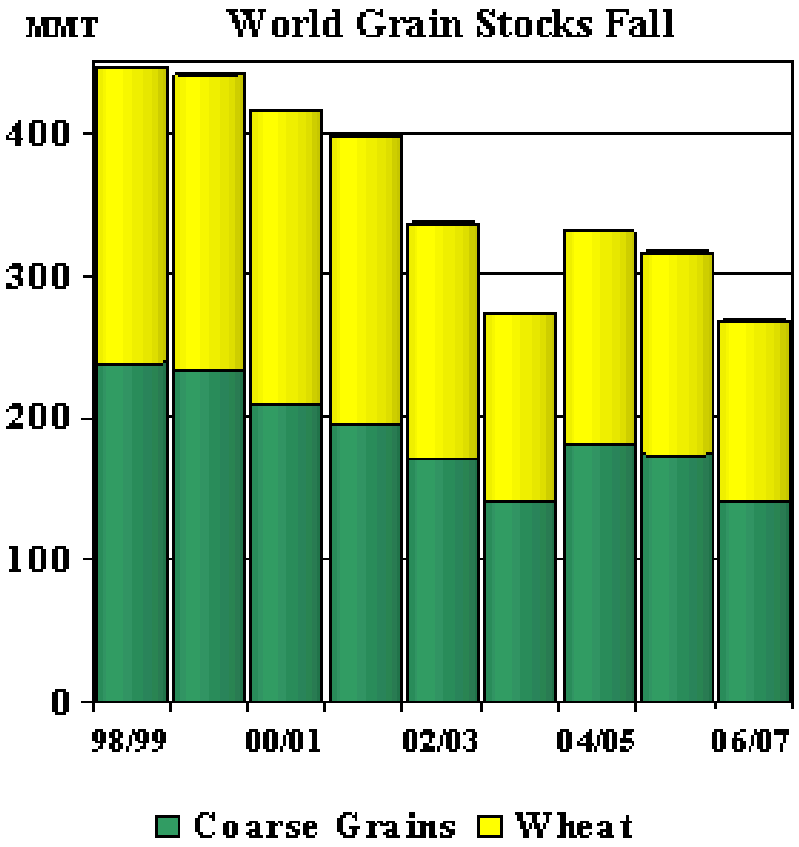
Agricultural Growth in India

Montek Ahluwalia

- **1960s – reliant on PL480**
- **1970s Green Revolution**
  - **Food self sufficiency - Ag GDP 1.4%**
- **1980s Ag Growth policy – Ag GDP 4.6%**
- **Since mid 1990s – Ag GDP 2%**
  - **2002-2003 – Ag GDP 1.1%**

World Grain Stocks





Hunger
Poverty
Economic Growth

Economic Growth

- **For much of Sub Saharan Africa Economic Growth**
  - **= Rural Economic Growth**
  - **= Growth in Agriculture, Forestry and Fisheries**
  - **Depends on Renewable Environmental Resources**
    - **Soils, Water, Enemies of pests, Trees, Fish**
- **Hence Economic Growth depends on Sustainable Agriculture**

The Benefits of Agricultural Growth

- **Key to halving poverty**
  - **it can provide increases in incomes for both farmers and farm labourers.**
  - **it has a significant multiplier effect on other economic activities (Every additional $1 of farm income generated creates a further $1 - 2 of income outside agriculture).**

Agricultural Growth

- **Key to halving hunger**
  - **directly for small farmers from their own production**
  - **by reducing prices of staple foods and improving their availability**
  - **by increasing government and private food stocks for times of shortage.**
- **it will also have an indirect positive effect on other MDGs, including those concerned with education and health.**

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

What do we mean by Sustainable Agriculture?

Marcus Terentius Varro

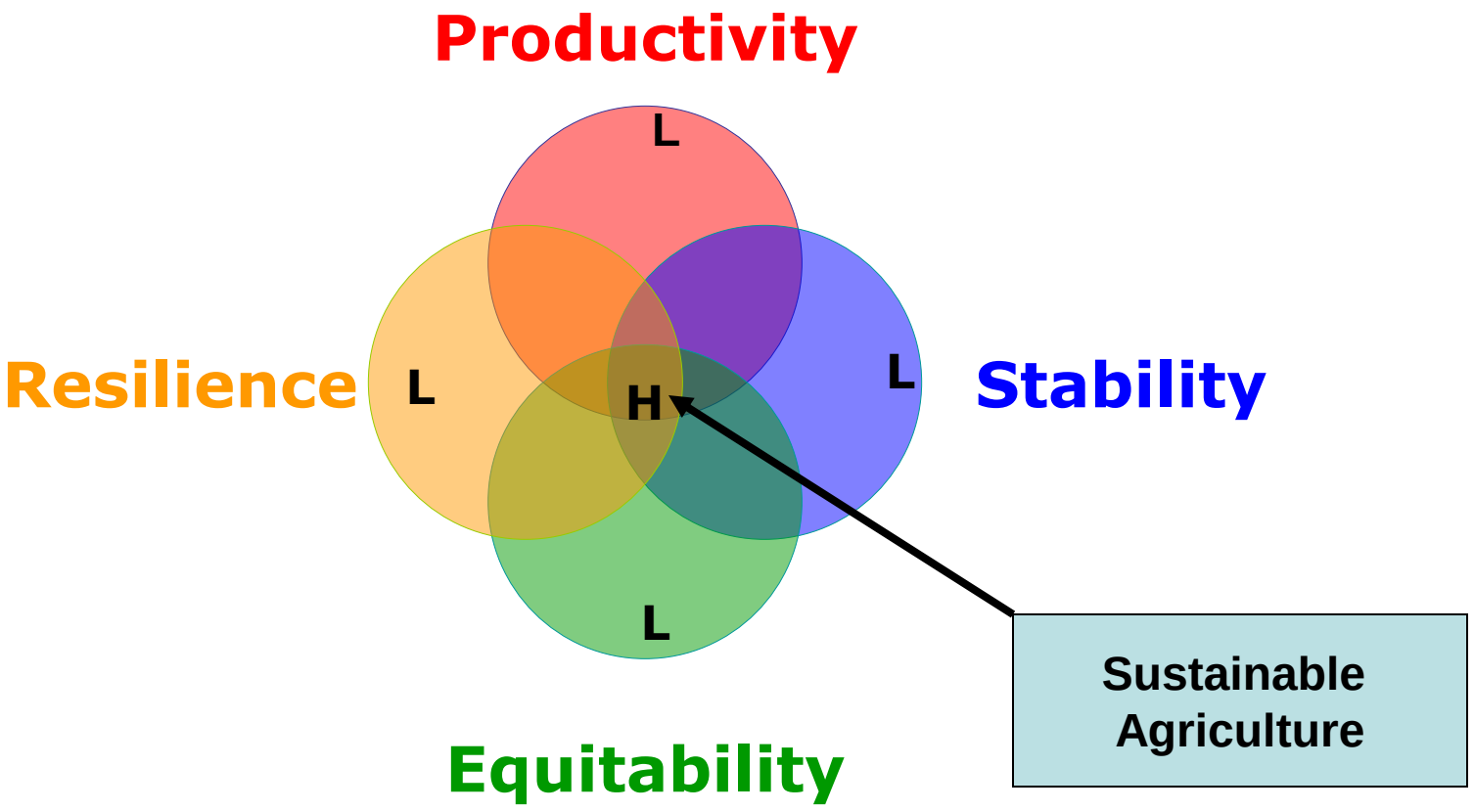
Agri cultura …Non modo est ars, sed etiam necessaria ac magna, eaque est scientia,

quae sint in quoque agro serenda ac facienda,

quo terra maximos perpetuo reddat fructus’

Rerum rusticarum

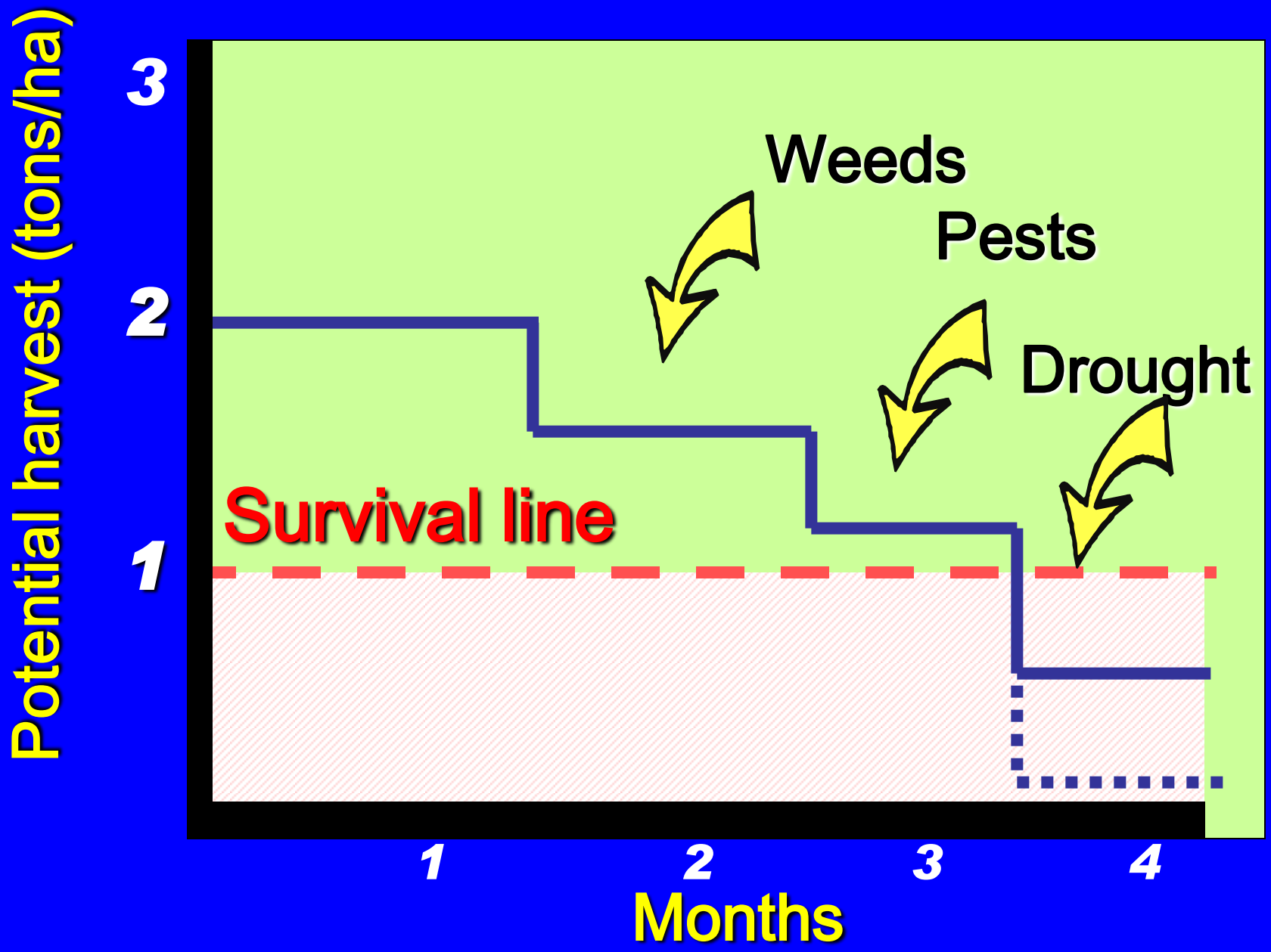
Minimising the Trade-Offs



Mrs. Namurunda

A single mother farming a hillside in western Kenya

Insecure Farm



We need Appropriate Technologies

- **Traditional Technologies**
- **Intermediate Technologies**
- **Conventional Technologies**
- **Advanced Technologies**

Integrated Pest Management

Parasite of Cassava Mealybug

Han Herren 1995

Integrated Nutrient Management

INORGANIC
(fertilizers)

ORGANIC
(plant residues, etc.)

Synergy

Green manures
Reduced tillage
Rotations & intercropping
Integration with animals
Crop diversification

Pedro Sanchez
2002

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.

Cheap

Accessible

Sustainable

Technologies

that are efficient

Treadle Pump

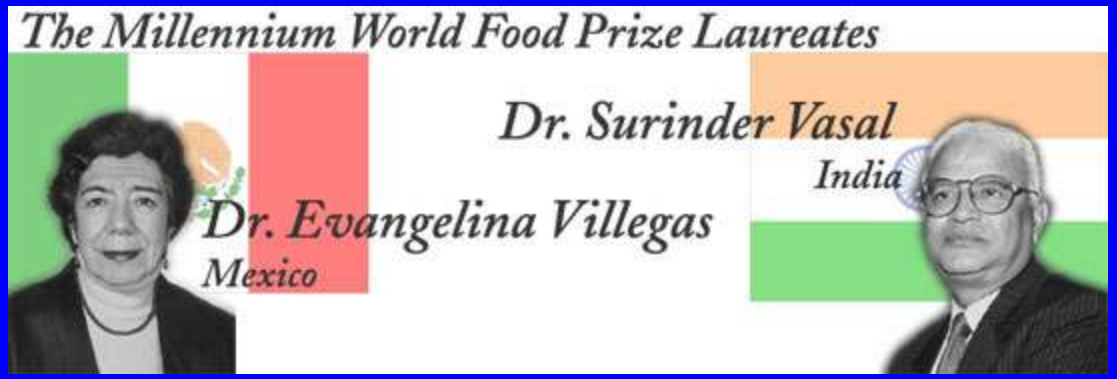
But often

- Labour intensive
- Require relatively high level skills
- Poorly available

Conventional Technologies

Quality Protein Maize

opaque kernel **yellow vitreous** **white QPM**



Back

Eradication of Rinderpest

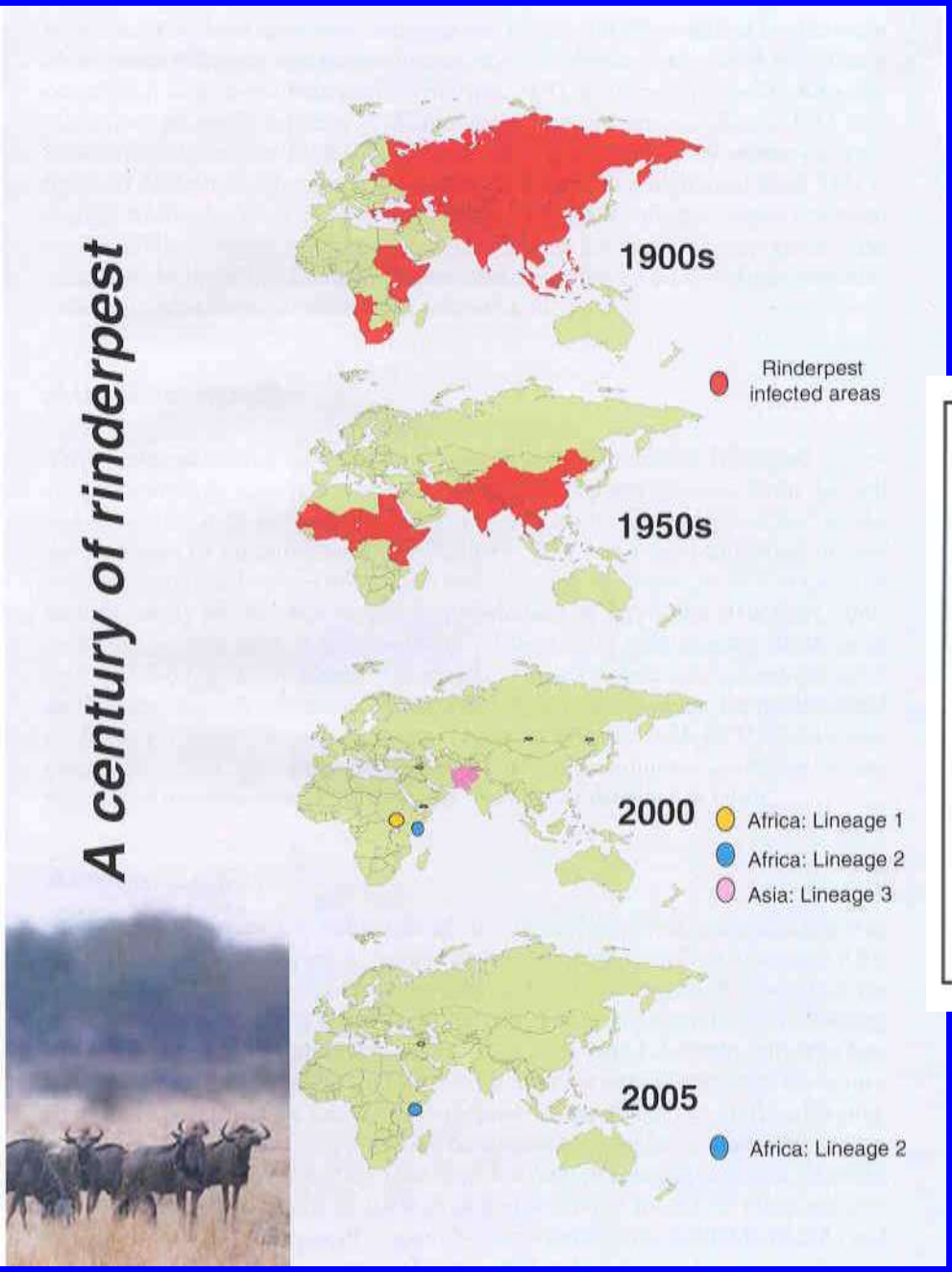
A Vaccine in the 1960s

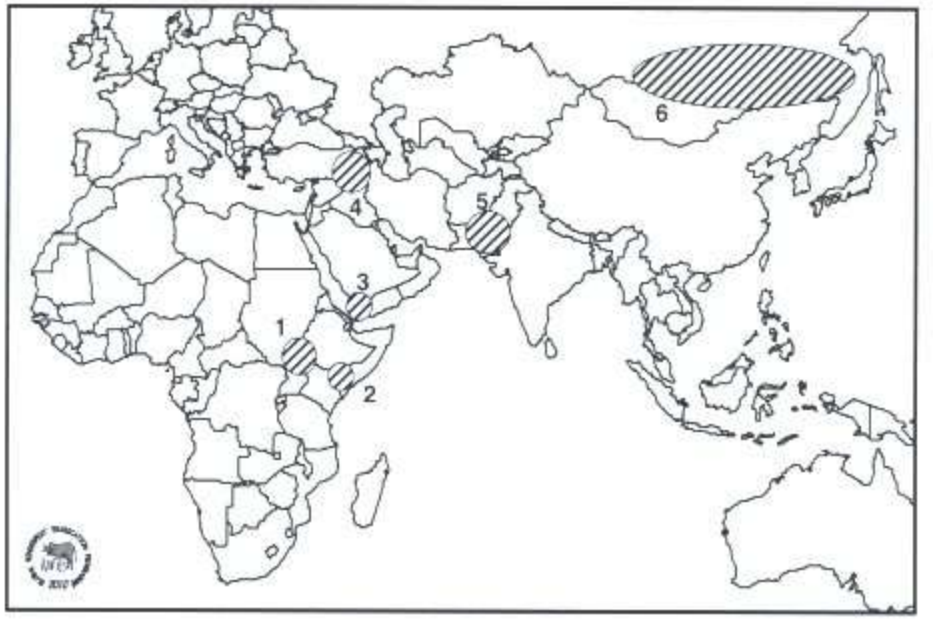
United Kingdom

Dr. Walter Plowright

1999 World Food Prize Laureate

Rinderpest





The Reservoirs

Advanced & Platform Technologies

- Information & Communication Technologies
- Biotechnology
- Nanotechnology
- New Materials

Sustainable Agriculture in the Seed

Tissue Culture

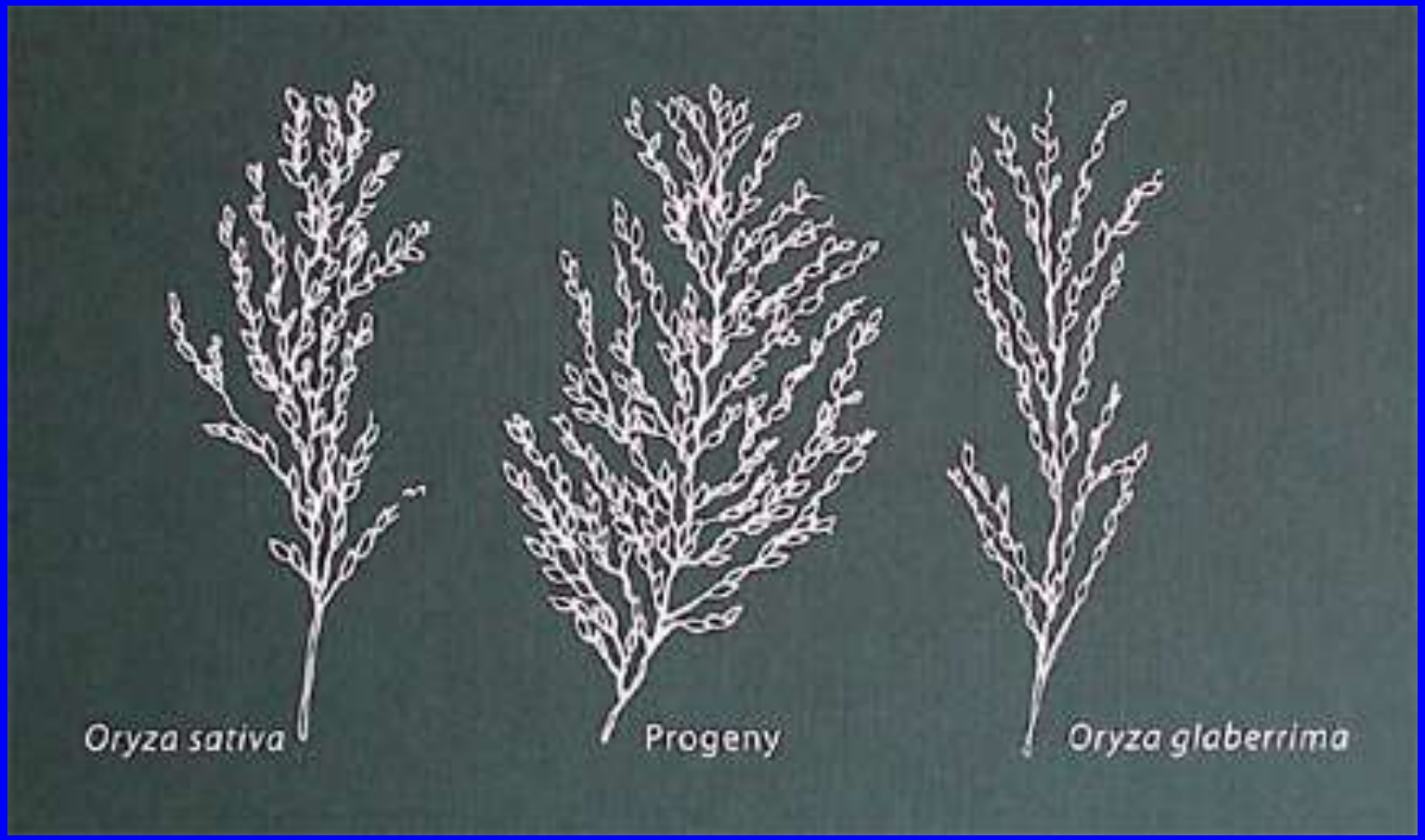
Marker-aided Selection

Genetic Engineering (GM)

The New Rices for Africa

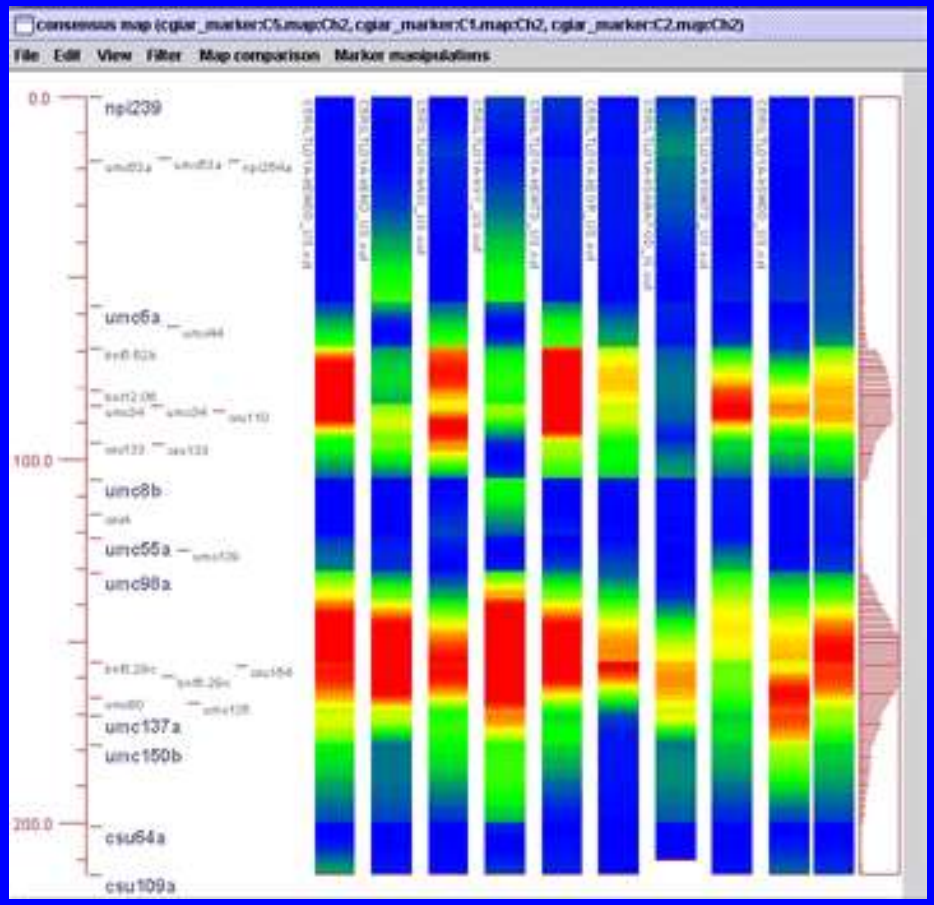
Monty Jones
2004

African X Asian Rices



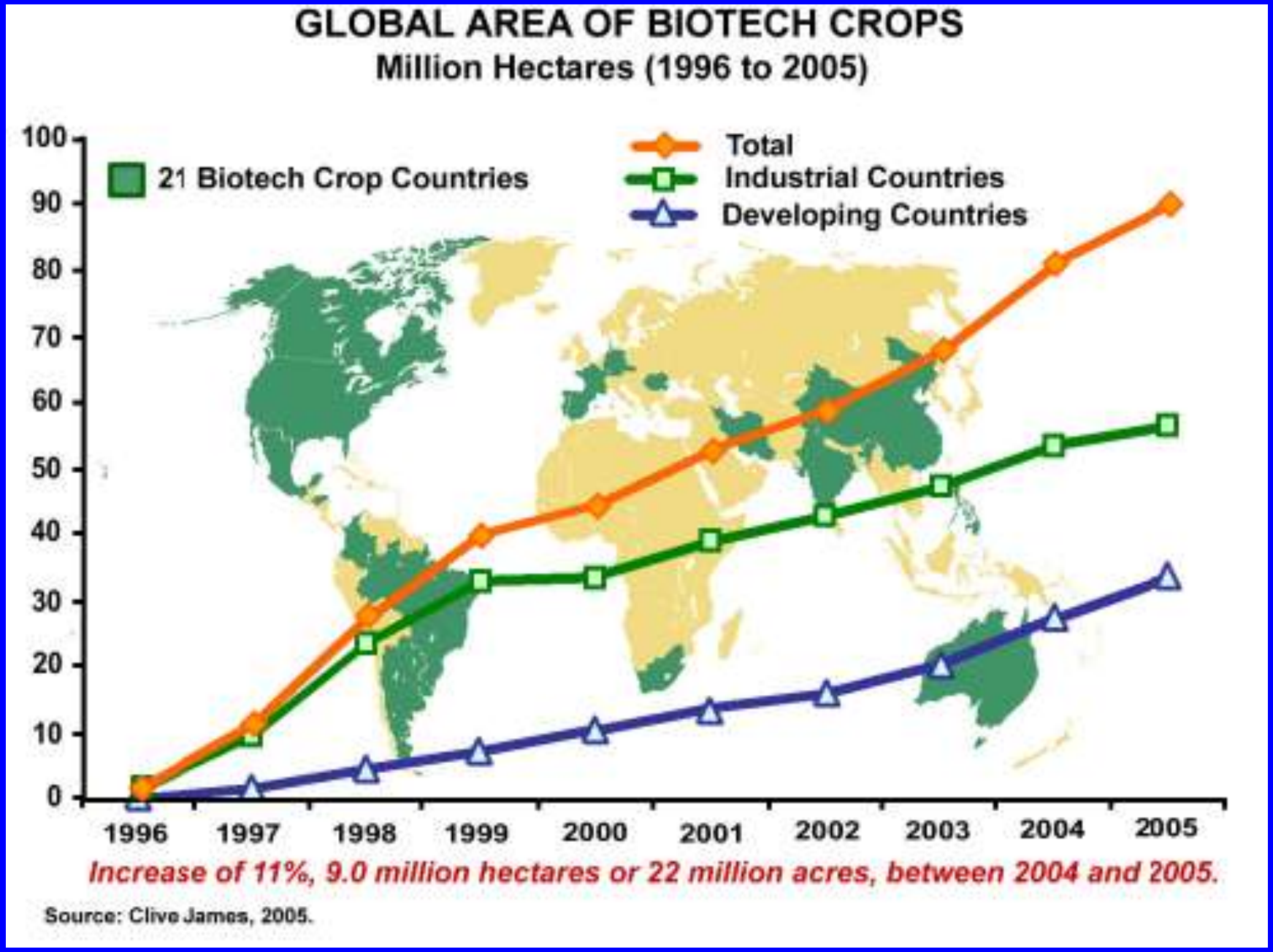
Marker- Aided Selection

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



Genetic Engineering

(Genetic Modification – GM)


GLOBAL AREA OF BIOTECH CROPS
Million Hectares (1996 to 2005)
21 Biotech Crop Countries
Total
Industrial Countries
Developing Countries
100
90
80
70
60
50
40
30
20
10
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Increase of 11%, 9.0 million hectares or 22 million acres, between 2004 and 2005.
Source: Clive James, 2005.

Uganda

Equity & Access

- Access to Proprietary Technologies
- Access to Markets

African Agricultural Technology Foundation

African-led and based, freestanding, not-for-profit

Responsive to smallholder needs

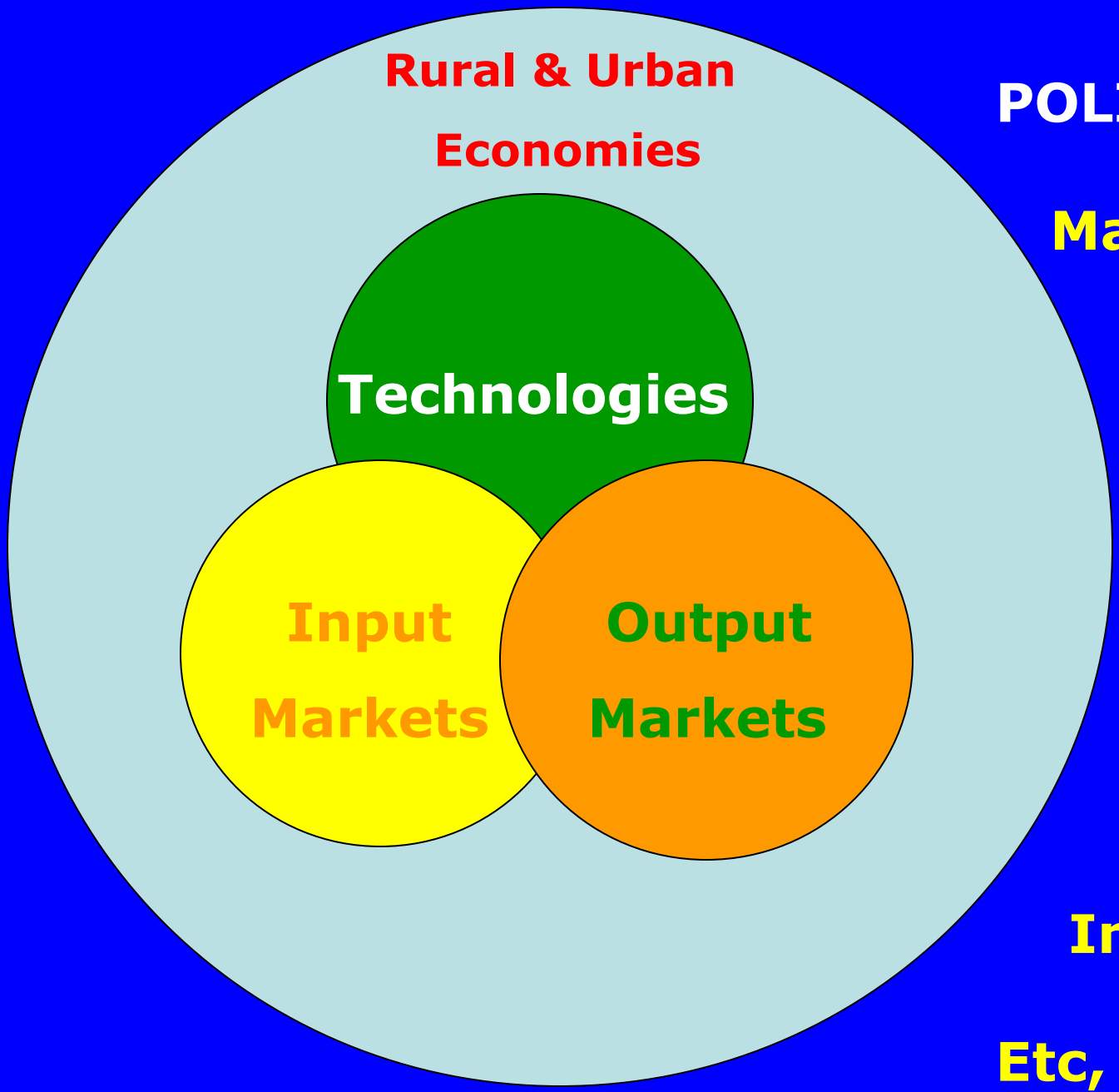
- Licensing agreements for existing technologies
- Adaptive R & D
- Regulatory consent
- Delivery
- Stimulate new technologies

Input Markets


No. 24
THE CORN'S
CO-OPERATIVE
SOCIETY
LIMITED

Agrodealers

Output Markets
Cereal Bank in Western Kenya



POLICIES

Markets

Trade

Credit

Land Reform

Science & Technology

Infrastructure

Etc, etc

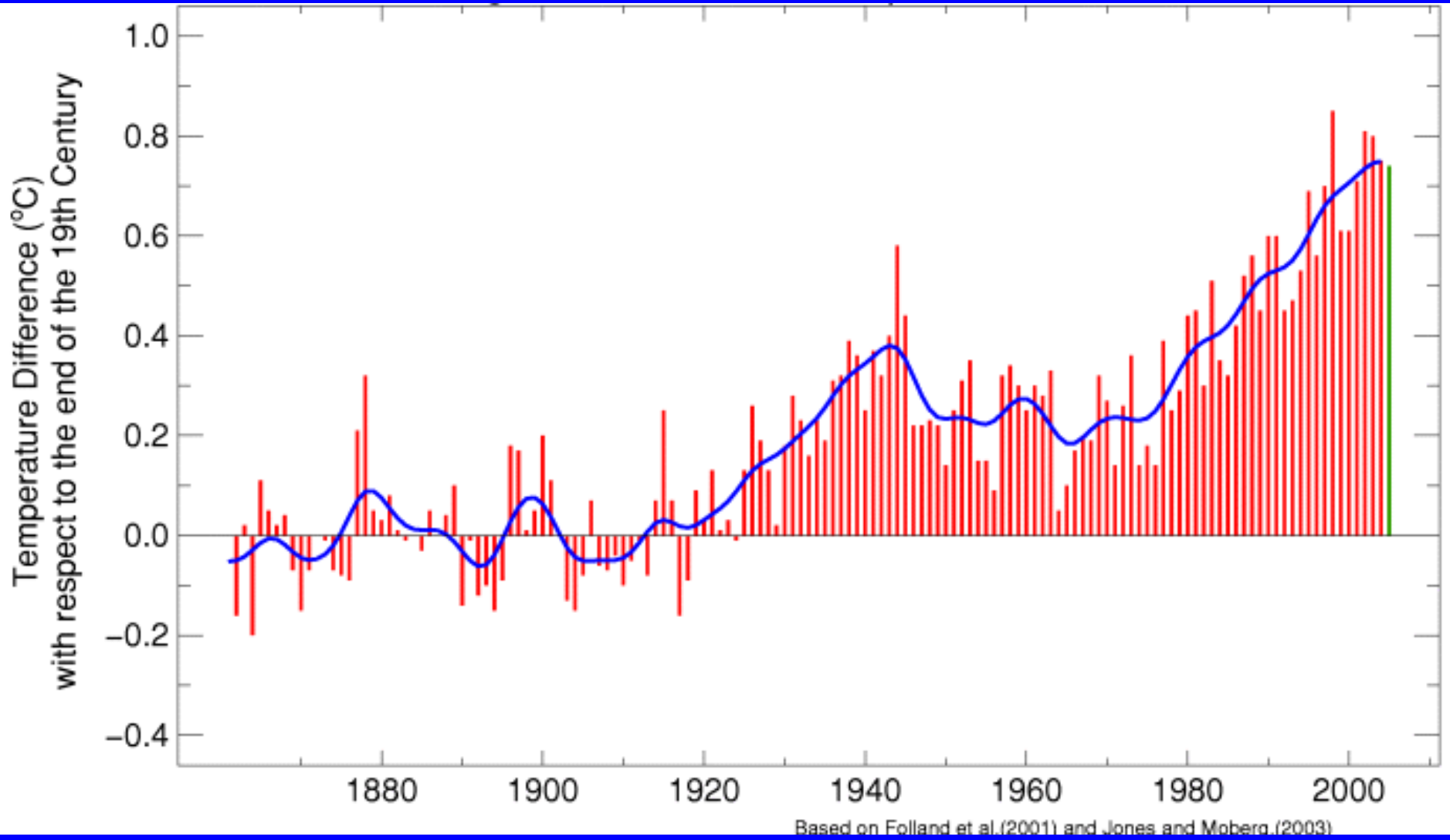
A Case Study

The Loess Plateau in China

Loess Plateau

Finally Climate Change

Global mean temperatures are increasing



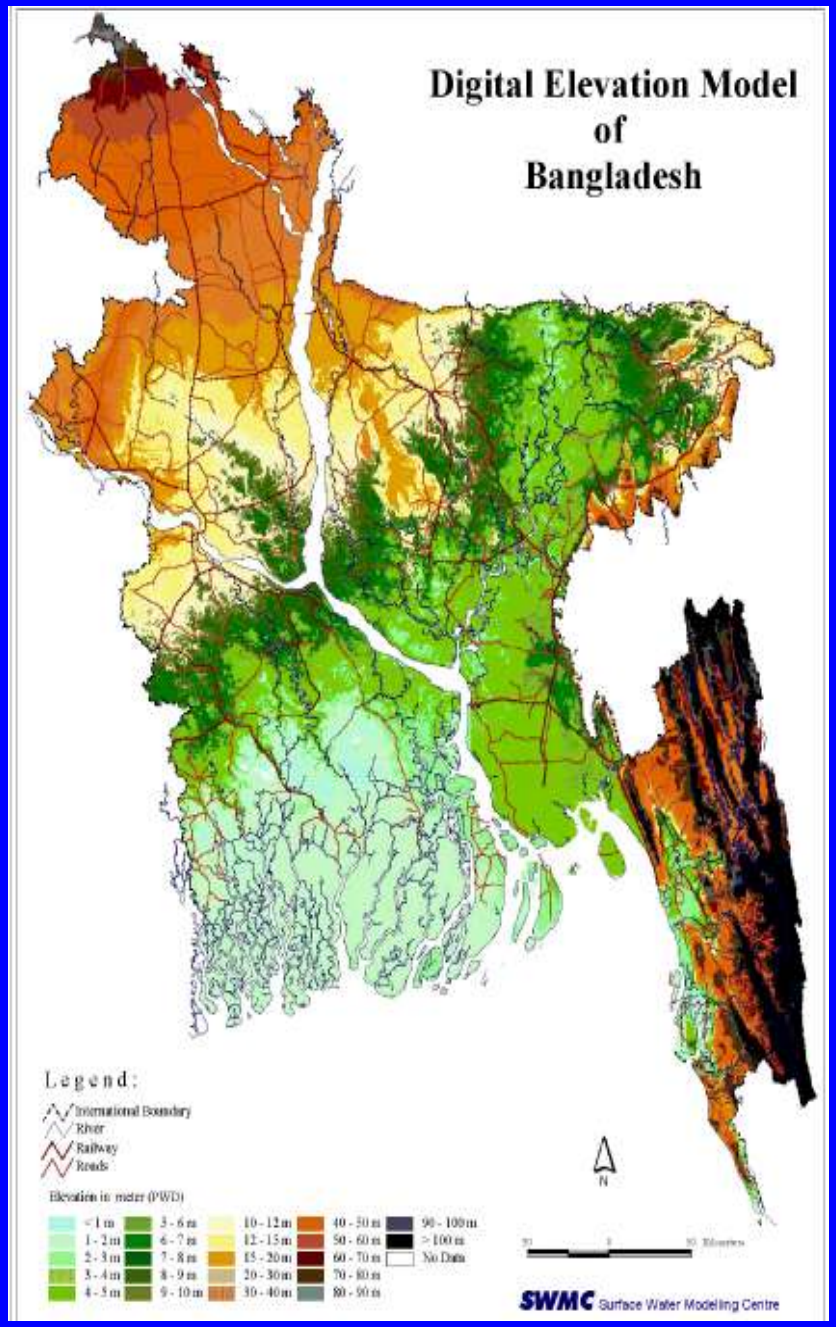
(Source: Met Office, UK)

Climate Change

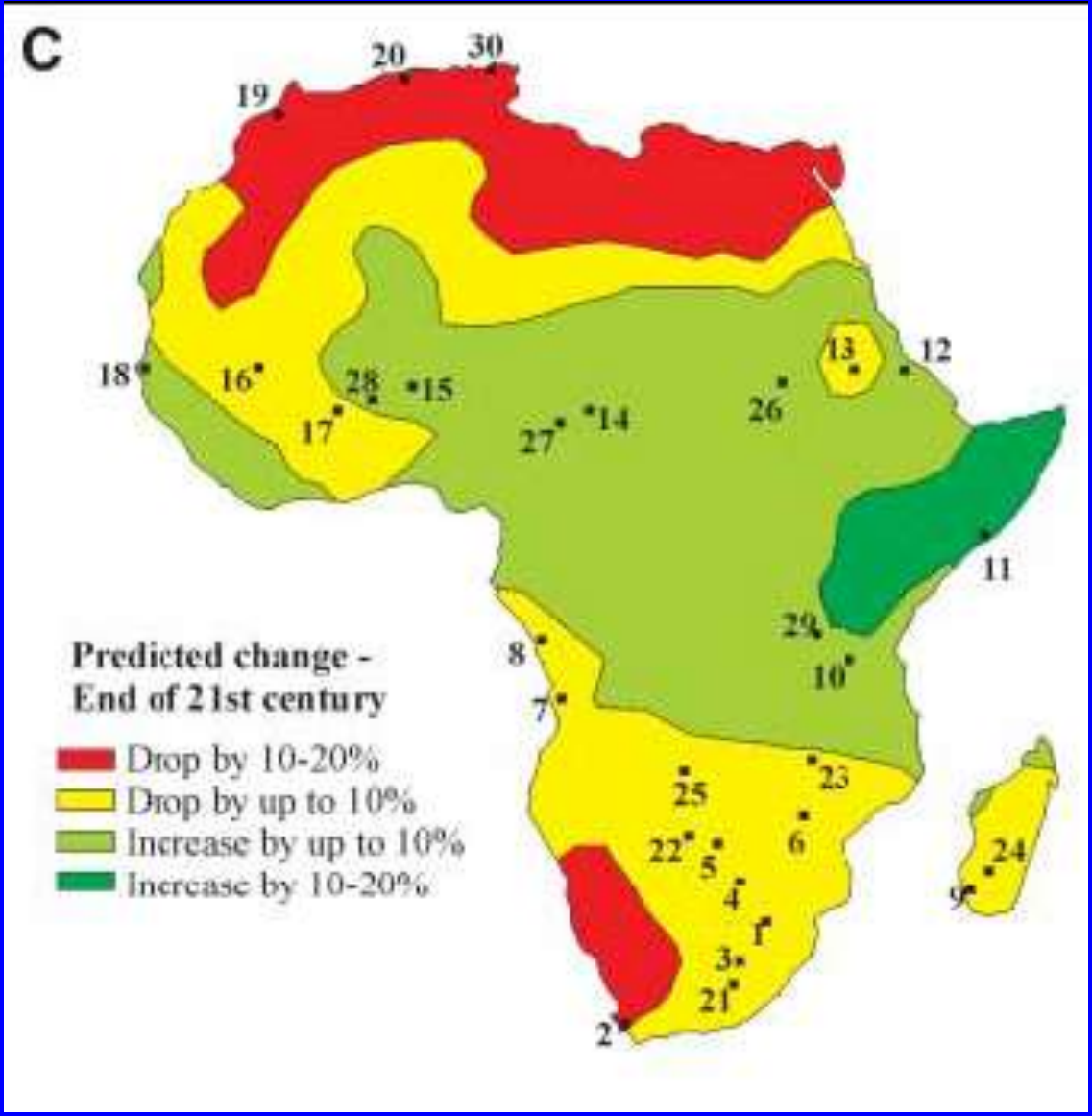
Temperature & Water

Consequences of Global Climate Change

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


Digital Elevation Model
of
Bangladesh
Legend:
International Boundary
River
Railway
Roads
Elevation in meter (PWD)
< 1 m
1 - 2 m
2 - 3 m
3 - 4 m
4 - 5 m
5 - 6 m
6 - 7 m
7 - 8 m
8 - 9 m
9 - 10 m
10 - 12 m
12 - 15 m
15 - 20 m
20 - 30 m
30 - 40 m
40 - 50 m
50 - 60 m
60 - 70 m
70 - 80 m
80 - 90 m
90 - 100 m
> 100 m
No Data
N
SWMC Surface Water Modelling Centre

Expected Change in Precipitation by end of 21st Century



De Wit &Stankiewicz 2006
Science, 311,`9`7-1921

Annual Losses to Drought

RICE

China: 4.4 MT or $880m

E. India: 2.9 MT or $580m

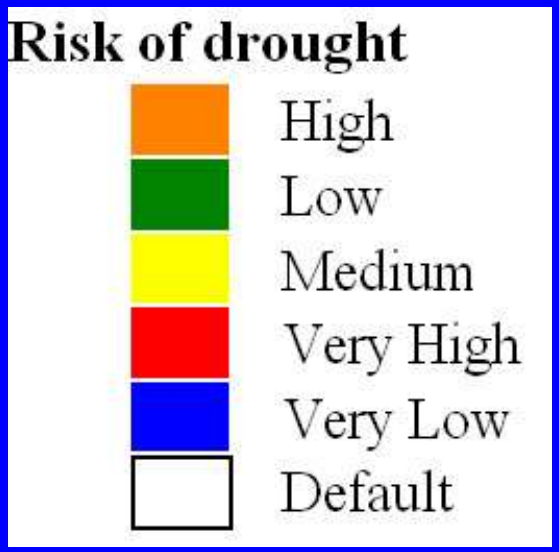
Global: 4% or 18 MT or $ 3.6b

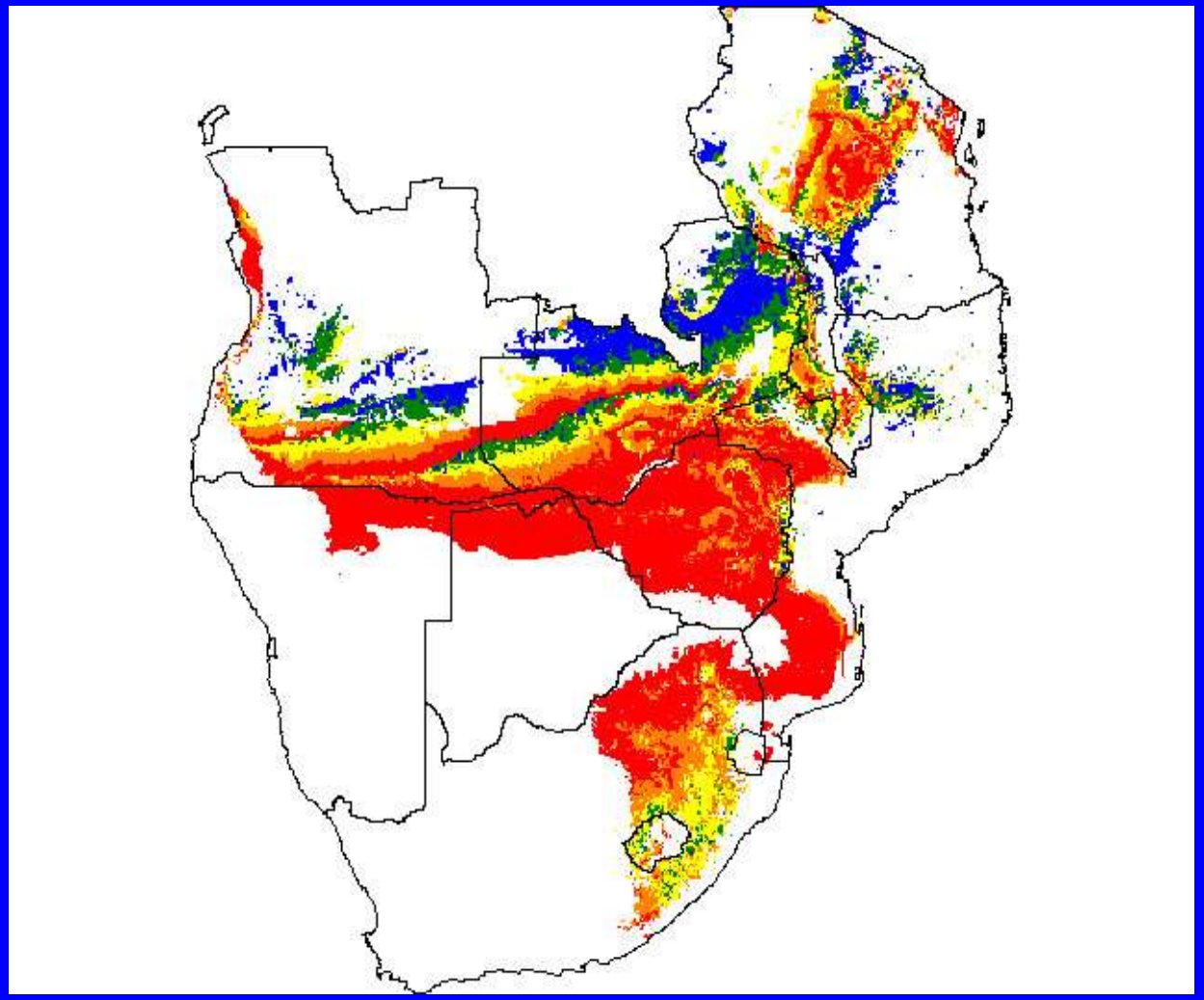
TROPICAL MAIZE

Global: 17% or >20 MT or $2.2 b

Maize in Southern & Eastern Africa

Grain-filling stage





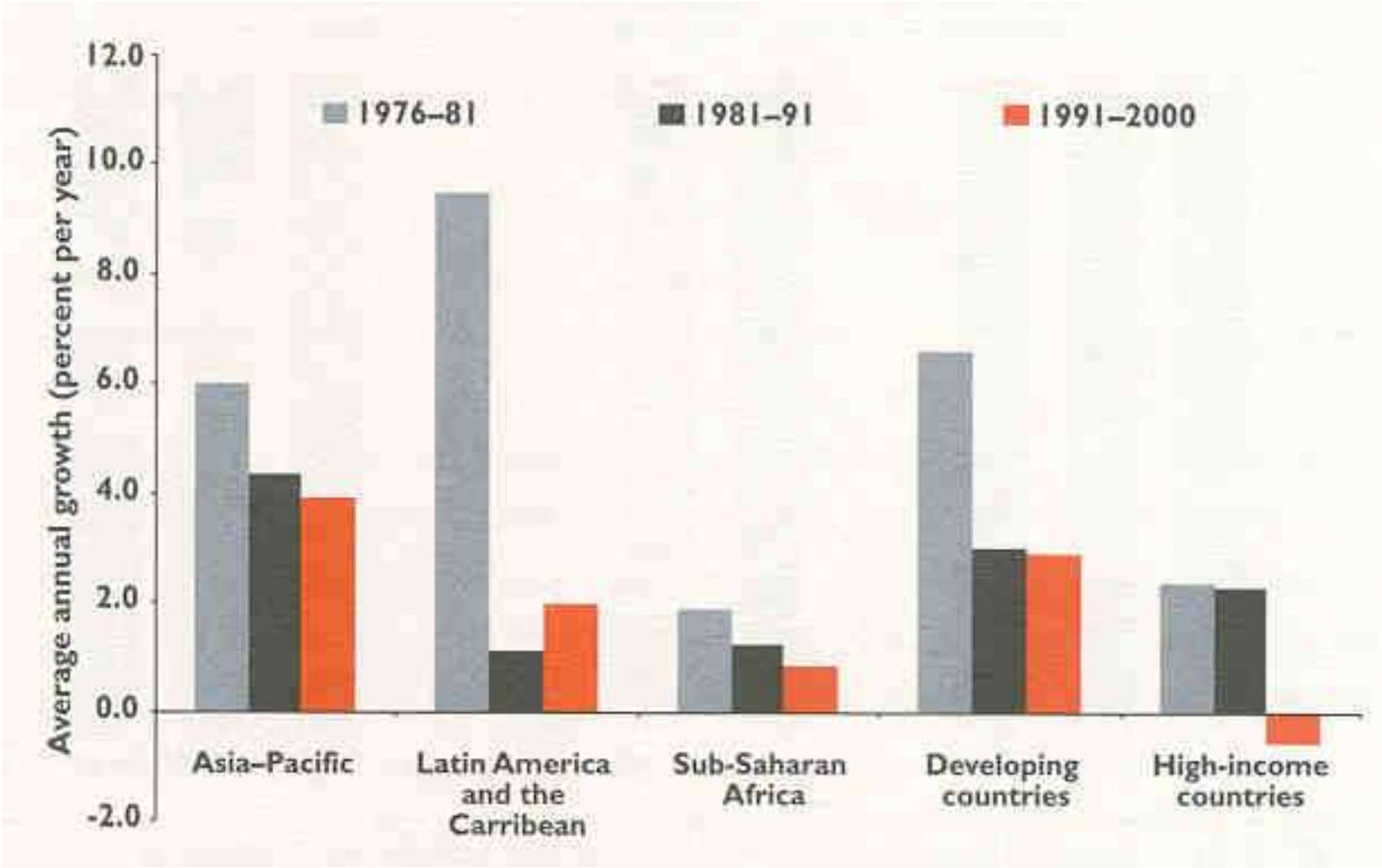
Lodging

Drought

To Combat Drought

- **Drought tolerant varieties and breeds**
- **Drought resilient cropping and farming systems**
- **Drought resilient livelihoods**

Public Agricultural R&D



Agricultural Research Spending, 2000

DFID White Paper July 12th 2006

- **Double** our funding for science and technology research, especially for better drugs and treatments, cleaner water, increased agricultural production and managing climate change – **about $375 million by 2010.**

Not just AID, but PARTNERSHIPS

- NEPAD
- CAADP
- FARA
- CORAF
- ASERECA
- SAREC
- AATF
- Plus PPPs and PPCPs