# Can we Free the World of Hunger and Malthus's Shadow Forever?

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IFPRI®

**FUTURE PROSPECTS: THE CASE FOR MALTHUSIAN OPTIMISM**
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October 9, 2012

# Key messages

- Malthus's prediction has not materialized thus far due to technological, institutional, and policy innovations
- Global agricultural output growth has been steady and is now productivity driven, but uneven across regions
- Current and future global food and nutrition challenges are large
- An integrated approach is needed to enhance global food and nutrition security and free the world of Malthus's shadow
- Australia has an active role to play

# Malthus's prediction

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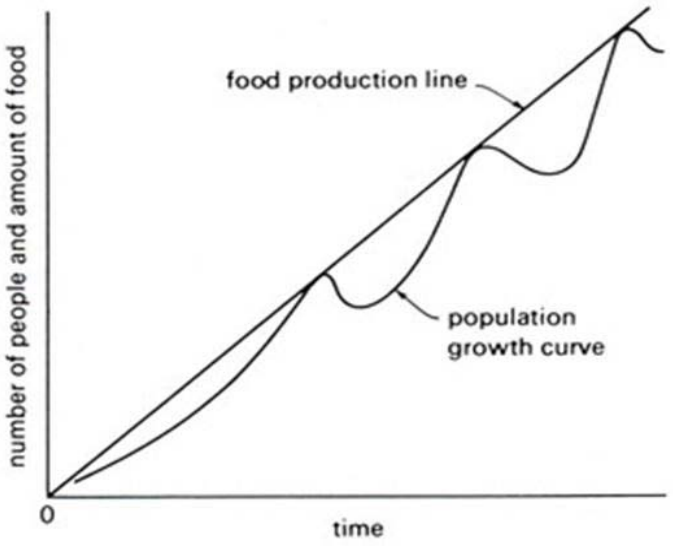


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*"Population when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio."*

Thomas Robert Malthus, 1809

**Population growth would eventually outpace food production growth**

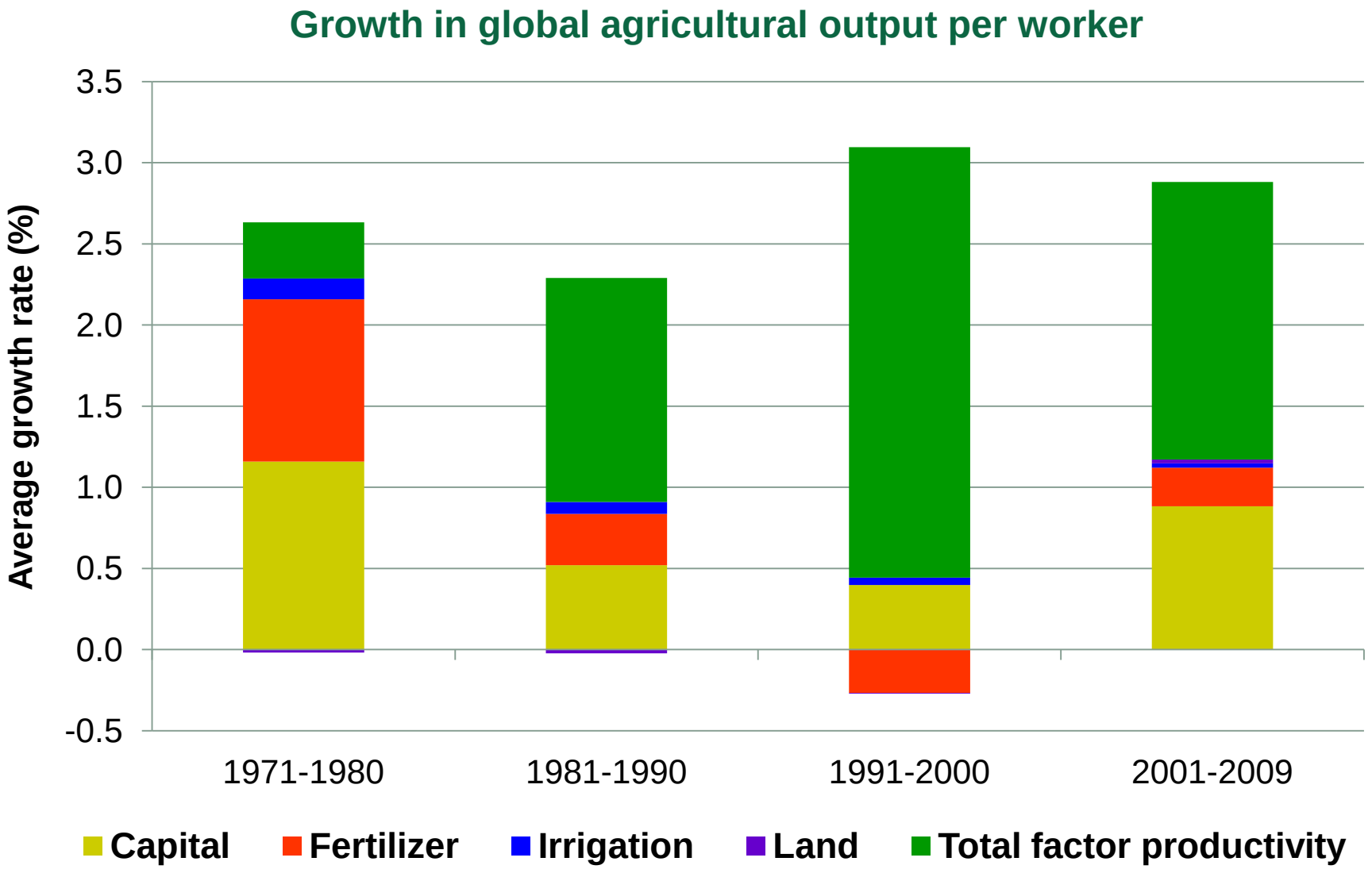
# Malthus's prediction has not materialized thus far

- **Technological, institutional, and policy innovations** have allowed food production to keep pace with population

- **Technological innovations** - Green Revolution in Asia, e.g.
  - Semi-dwarf, high-yielding varieties of rice and wheat adopted by many countries
  - Hybrid rice technology developed in China in mid 1960s, then adopted by other countries
  - As a result, cereal production and yields doubled (1965-1985)

- **Institutional and policy innovations, e.g.**
  - Broad-based agricultural development (China, India, and Vietnam)
  - Pragmatic and evolutionary trial-and-error approach (China)

# Global agric. growth has been steady and is now productivity driven

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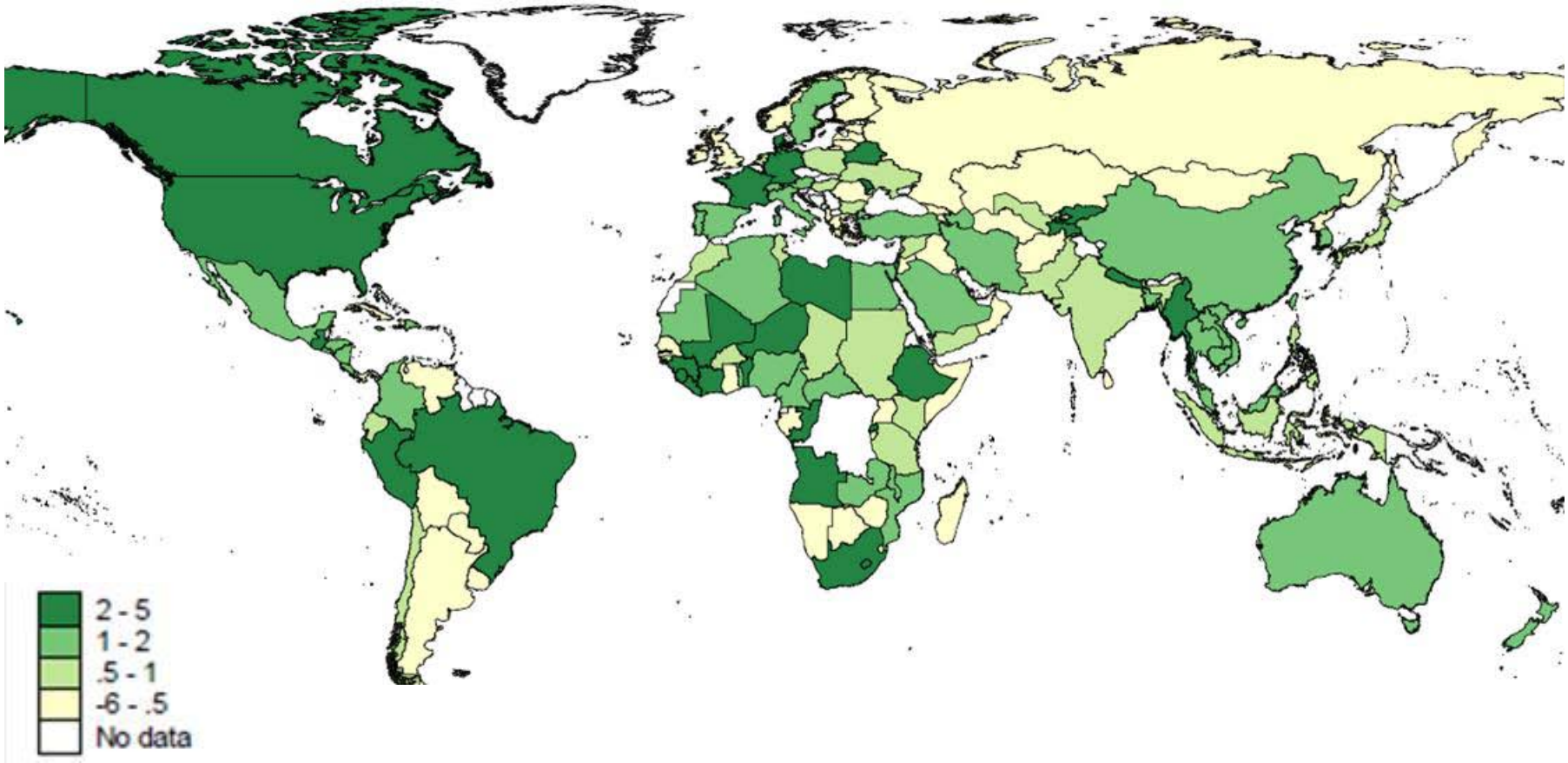
Source: Nin Pratt and Yu (IFPRI) 2012

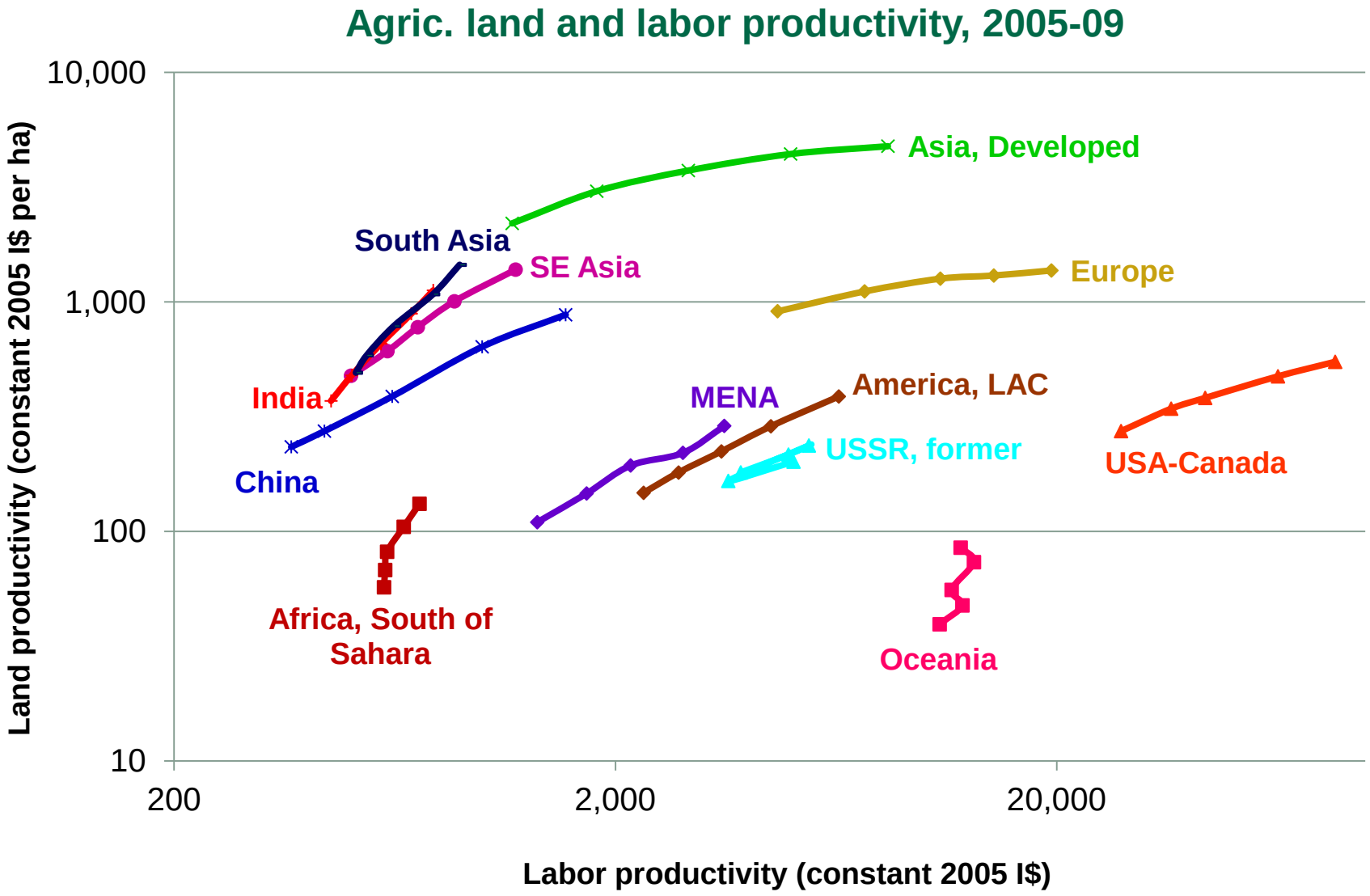
# BUT total factor productivity growth varies across countries

## Average annual agric. total factor productivity growth, 1995-2009 (%)




Source: Nin Pratt and Yu (IFPRI) 2012

# Agric. land and labor productivity has improved, but uneven across regions

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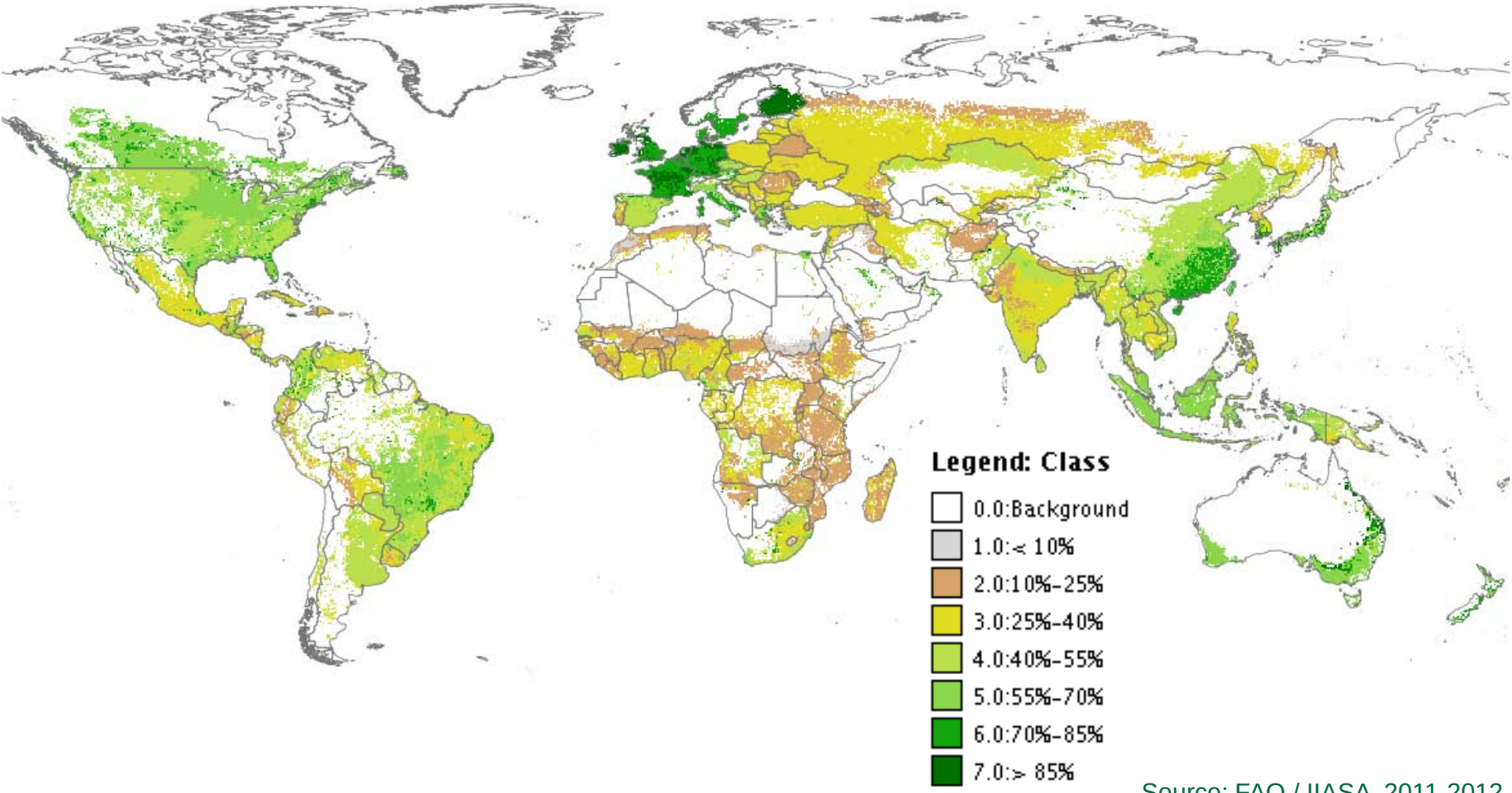
Source: Nin Pratt and Yu (IFPRI) 2012

# Crop yields have also improved, but large gaps remain

## Ratio of actual and potential yield, high input level, main crops, 2000




Source: FAO / IIASA 2011-2012

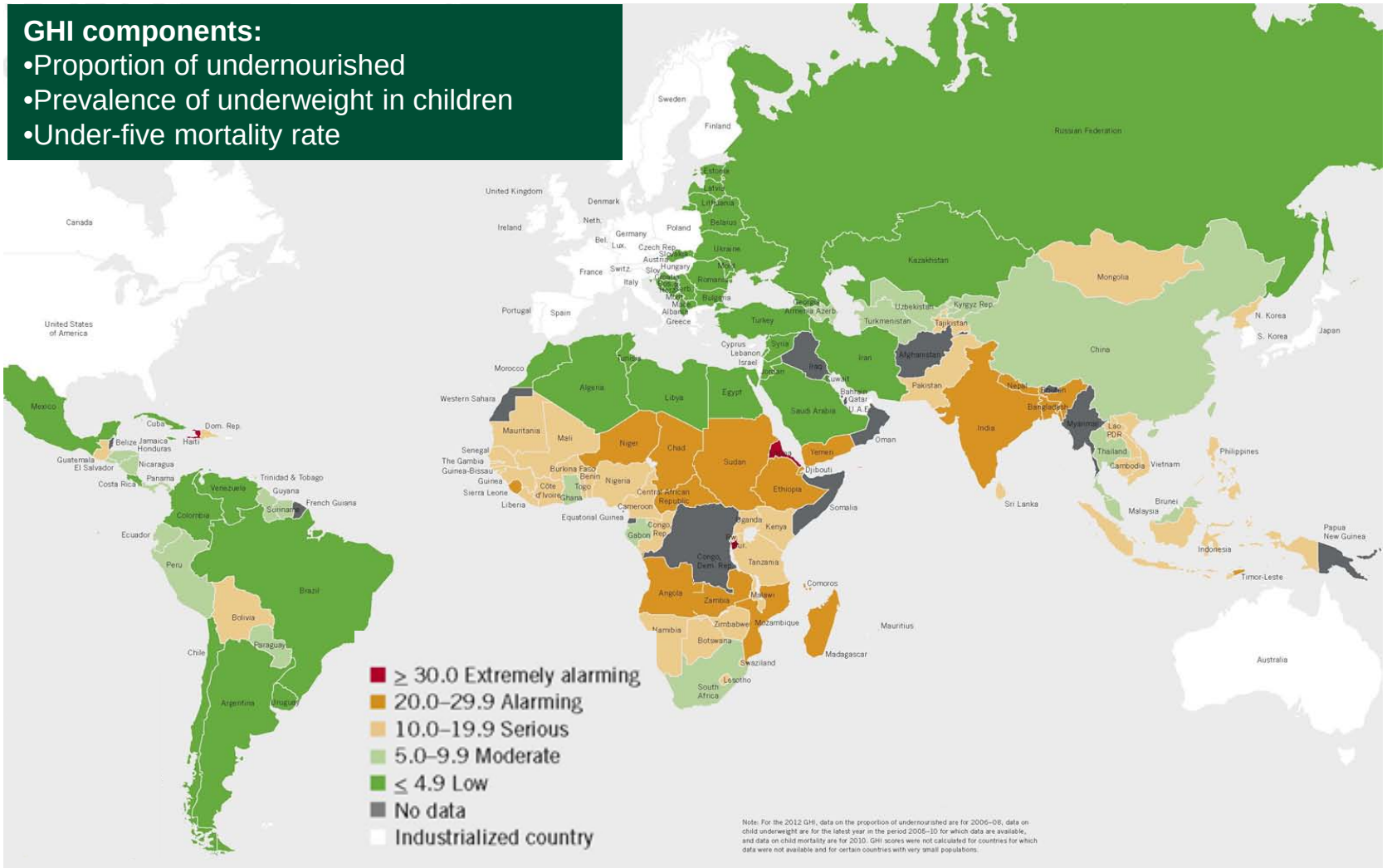
# Current and future challenges

- Persistent global hunger and undernutrition
- Increasing population and urbanization; rising incomes and demand; changing diets
- Growing natural resource constraints
- Rising oil prices / biofuel expansion; increasing volatility of food prices
- Changing climate and higher frequency / intensity of extreme weather events

# 50+ countries have serious / alarming / extremely alarming levels of hunger

## 2012 Global Hunger Index

**GHI components:**
- Proportion of undernourished
- Prevalence of underweight in children
- Under-five mortality rate

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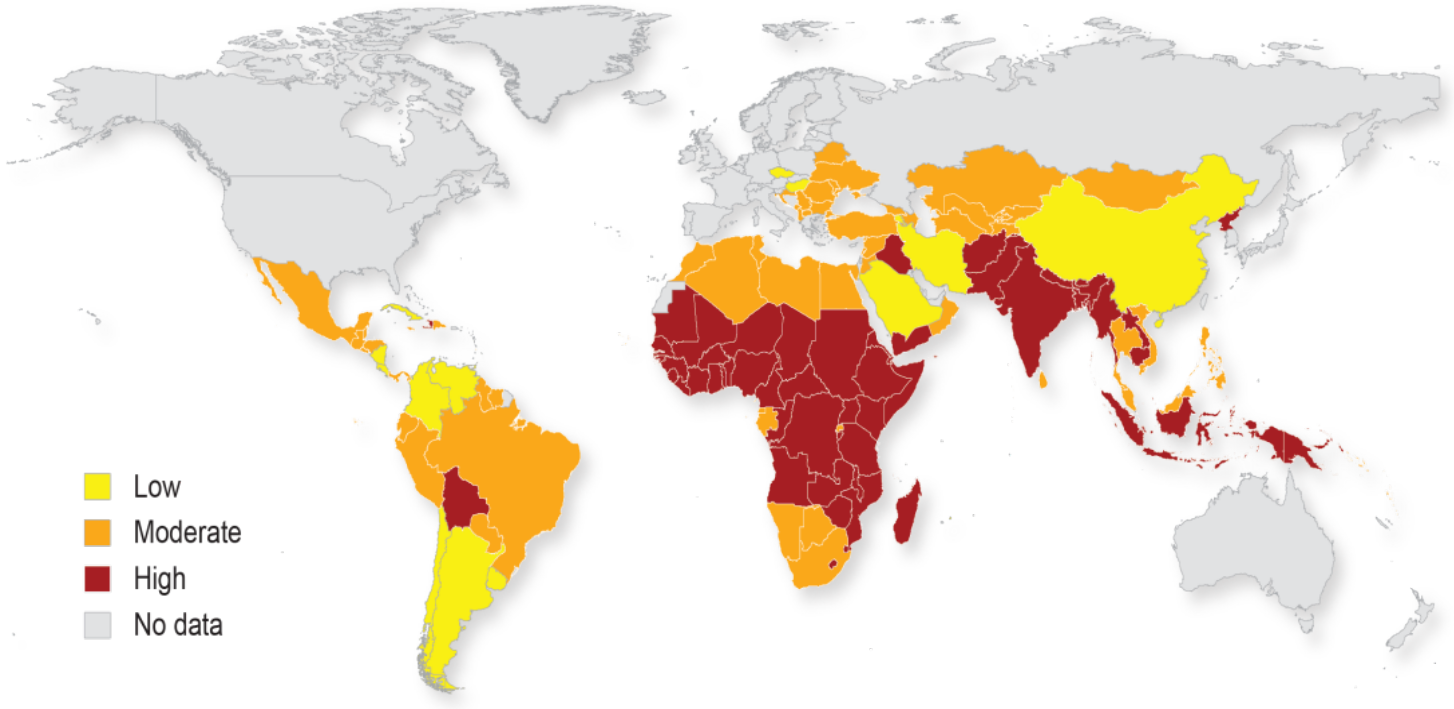
Source: von Grebmer et al. 2012

# 2 bil. + people suffer from hidden hunger

## Prevalence of micronutrient deficiencies



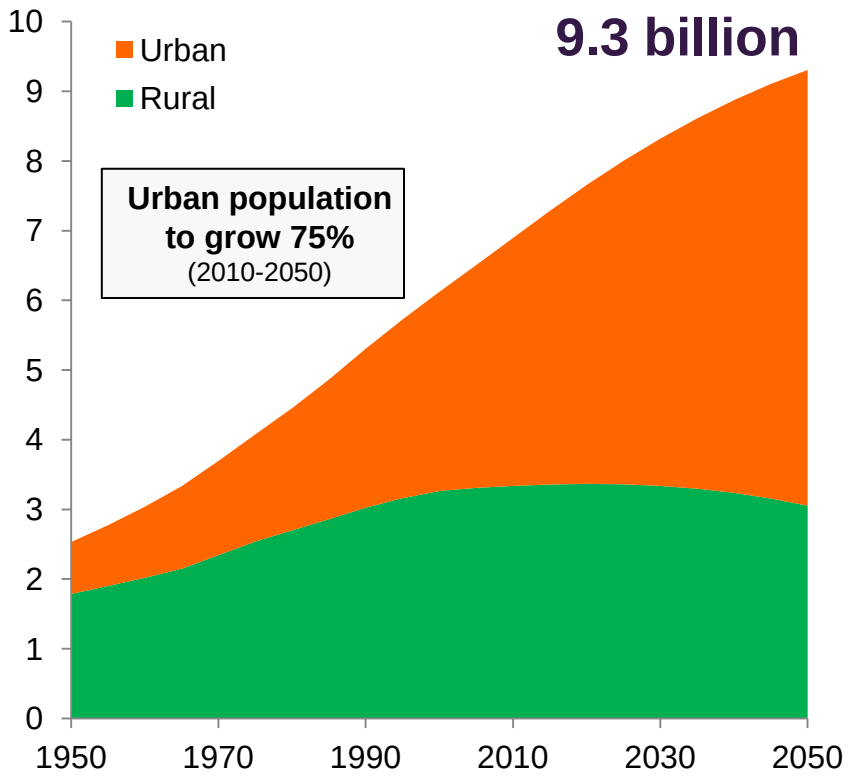

Source: HarvestPlus 2011

**E.g. India—economic cost of micronutrient deficiencies = US$17.3 bil.** (2004 dollars) or **2.5% of GDP per year**

(Stein and Qaim 2007)

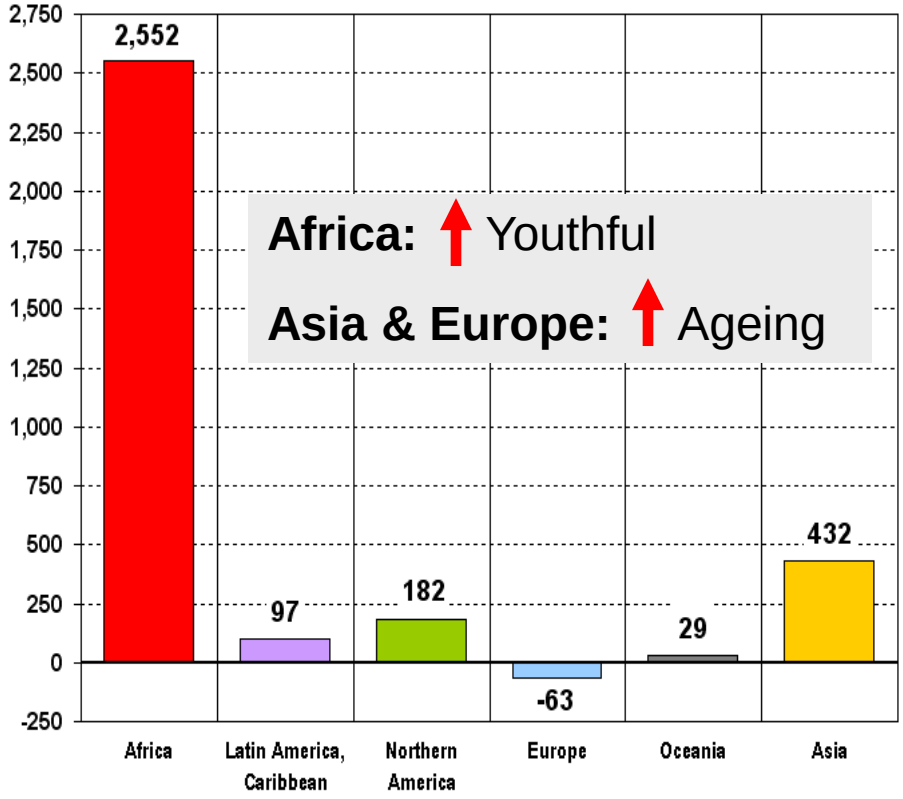
# Increasing population and demographic shifts

## World population (billions)




Source: Data from UN 2011

## Population change by region, 2010-2100 (millions)




Source: UN 2011

**Larger and more urban population will demand more and better food**

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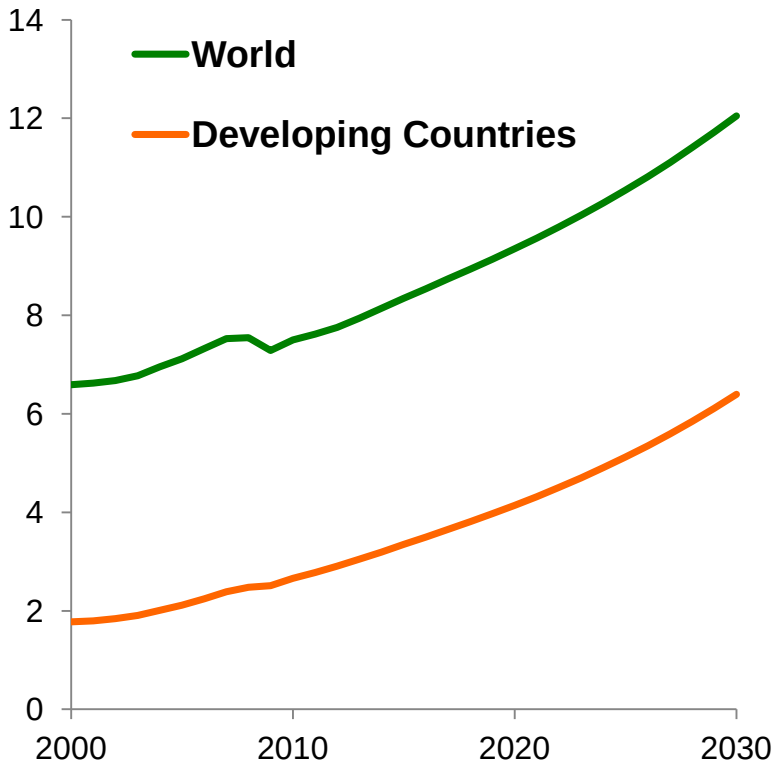
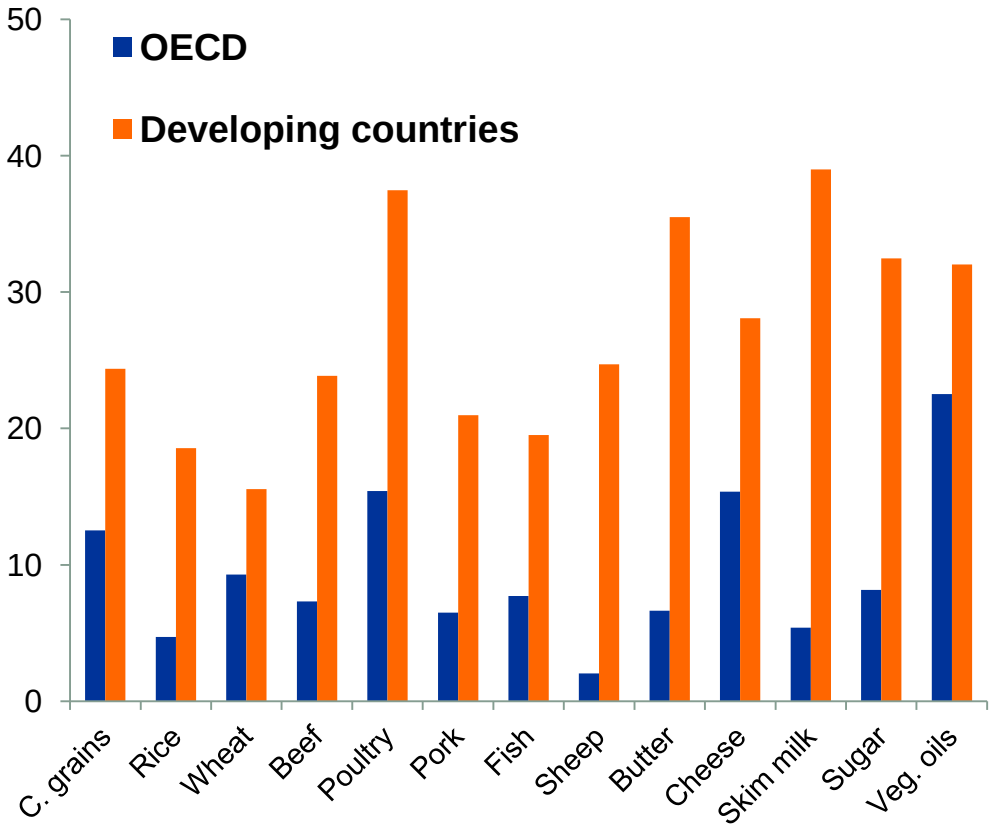
# Rising incomes and demand + diet changes

## GDP per capita $US ('000s)



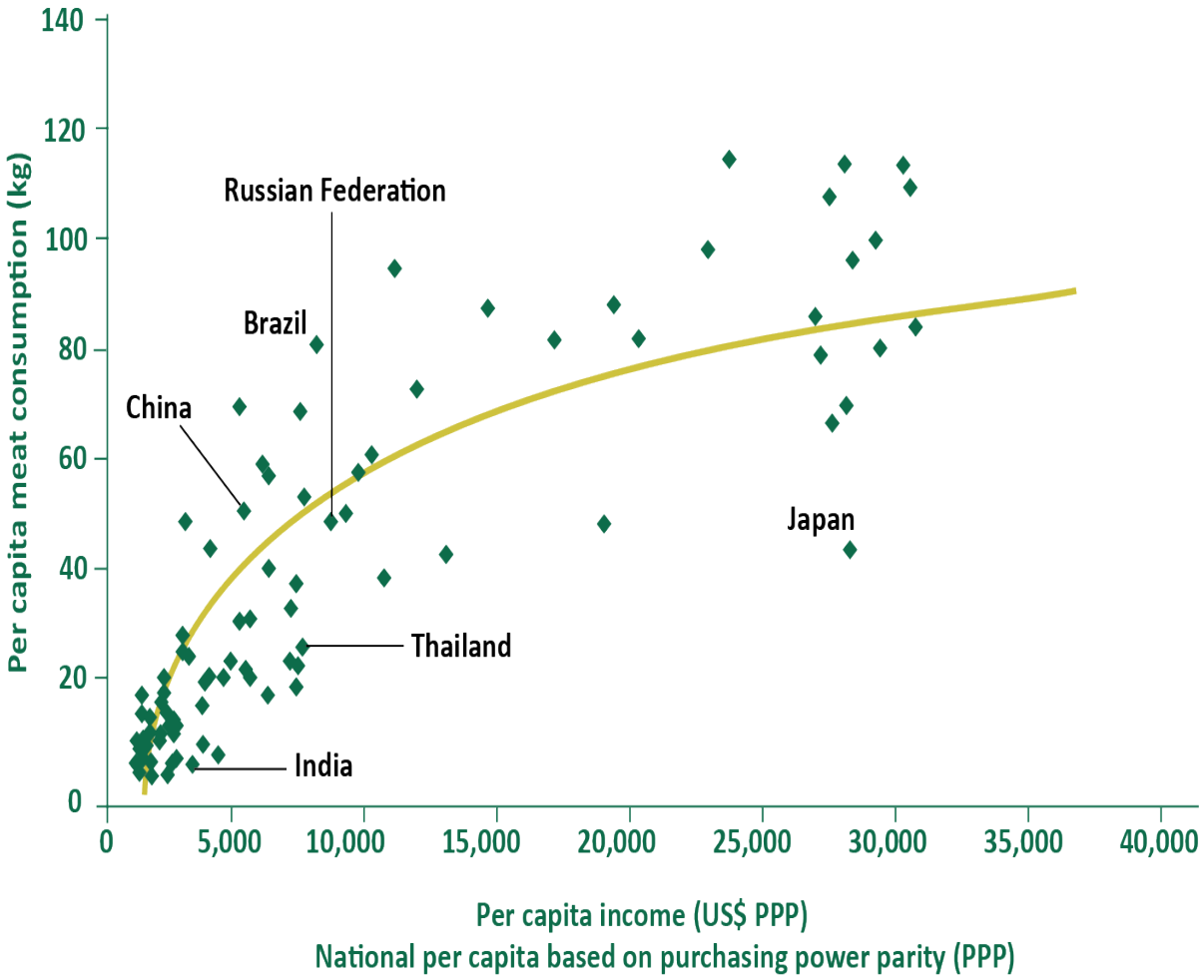

Source: ERS-USDA 2012

## Change in consumption of agric. products 2009-11 to 2021 (%)




Source: OECD-FAO 2012

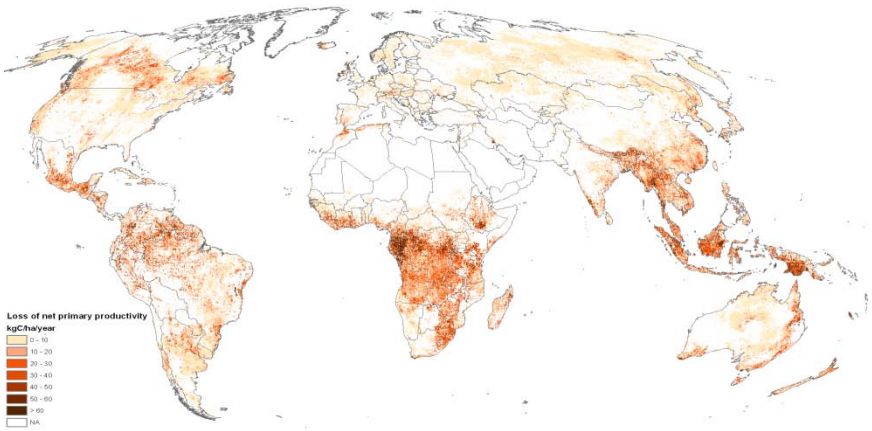
# Economic growth and meat consumption




Source: Rosegrant 2012

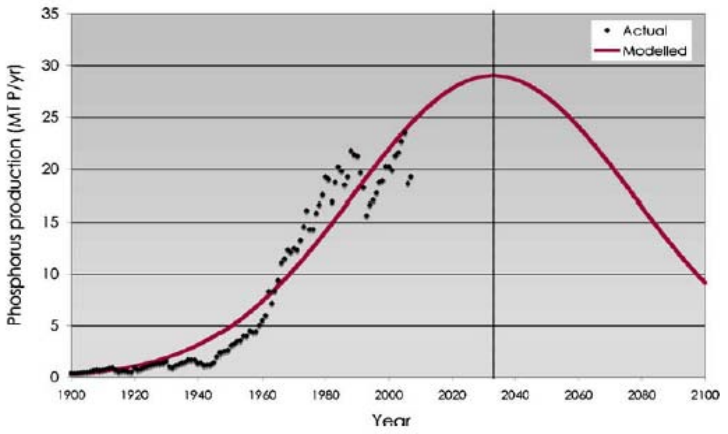
# Growing natural resource constraints

**Global loss of annual net primary productivity, 1981-2003**
(due to degradation)



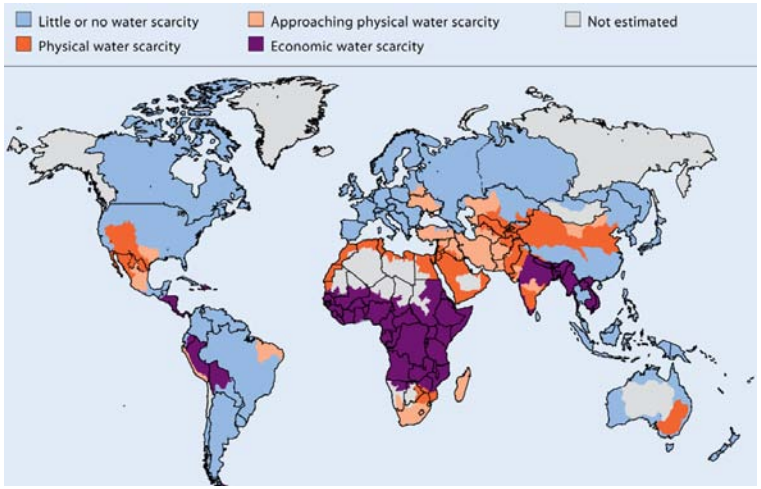

Source: Bai et al. 2007 (LADA, FAO/ISRIC)

**Peak phosphorus?**




Source: Cordell et al. 2009

**Physical and economic water scarcity**




Source: IWMI 2007

With "business as usual," high water stress by 2050 puts at risk globally:

- **52% of population**
- **49% of grain production**
- **45% of GDP**

Source: Veolia Water and IFPRI 2011

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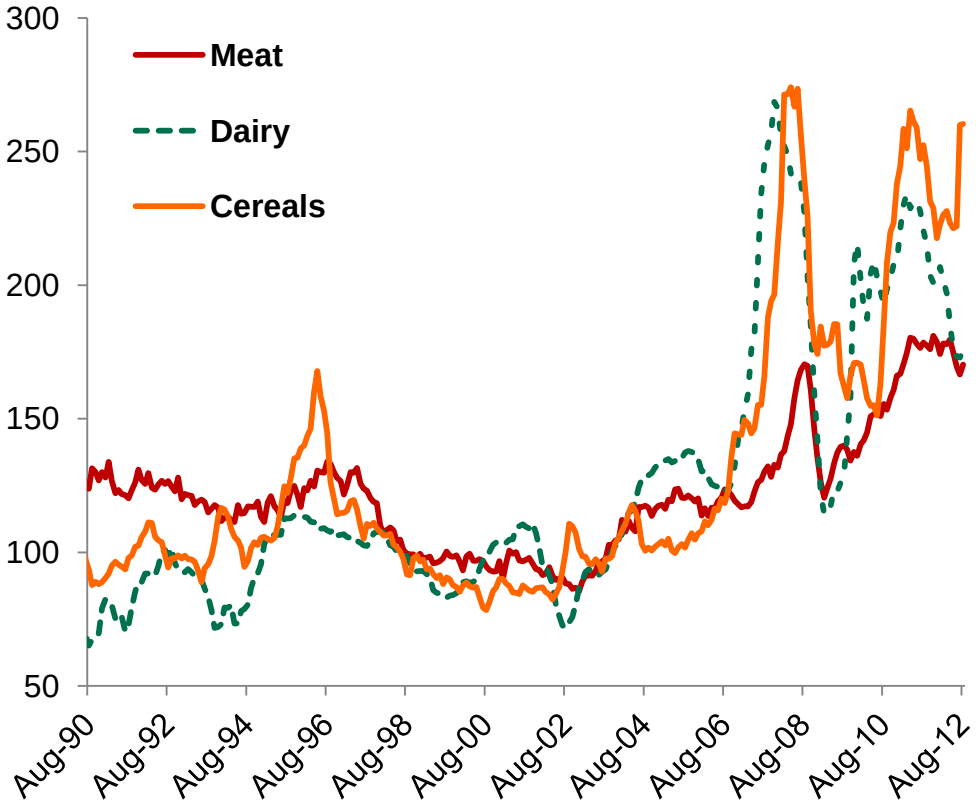
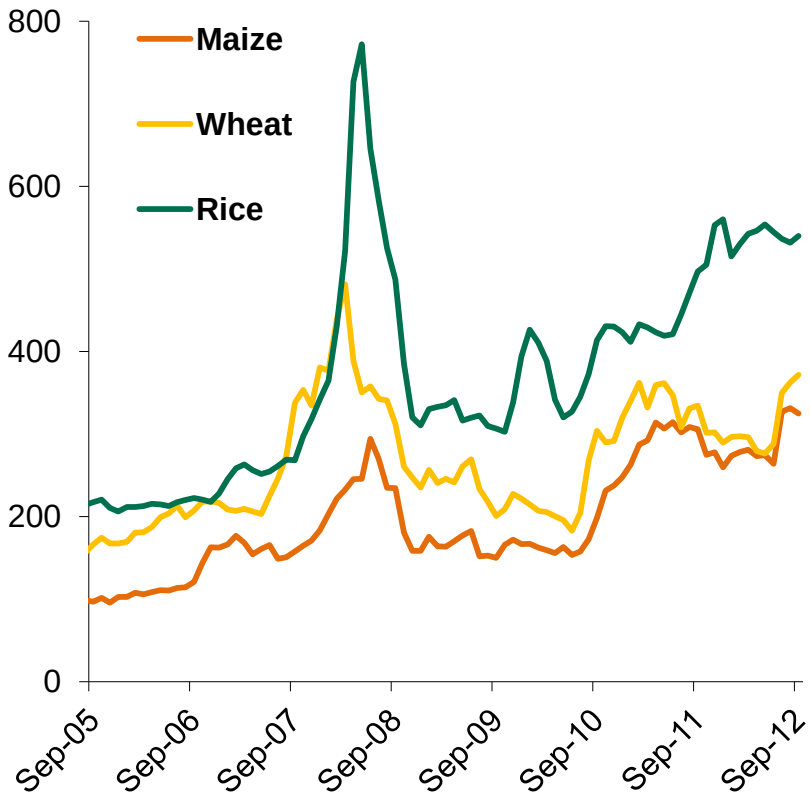
# Increasing volatility of food prices

## FAO food price index




## Global cereal prices (US$/ton)




**Maize prices up 23%, Wheat up 29% since June 2012**

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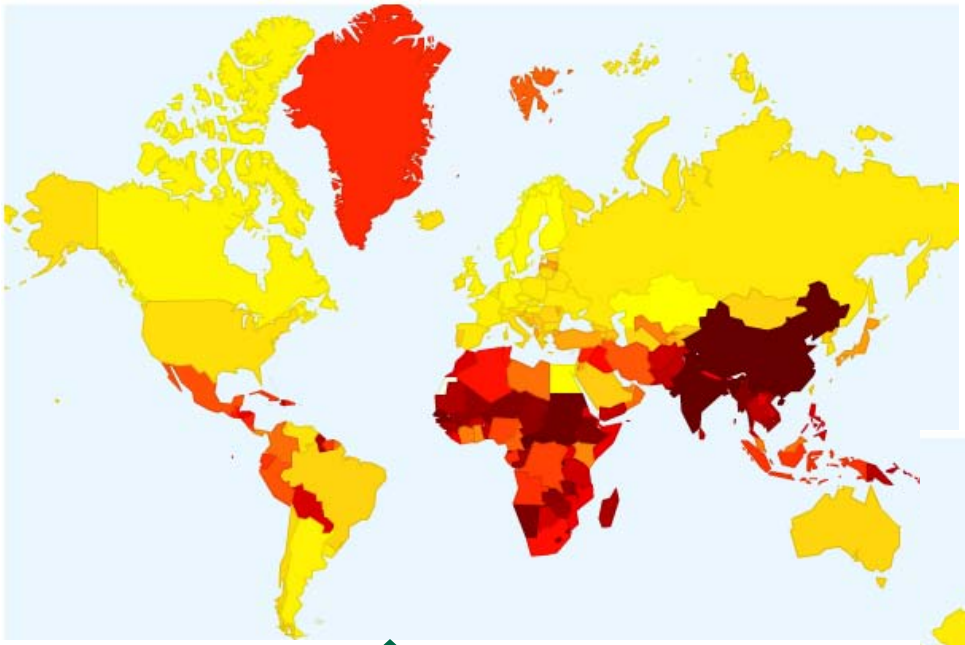
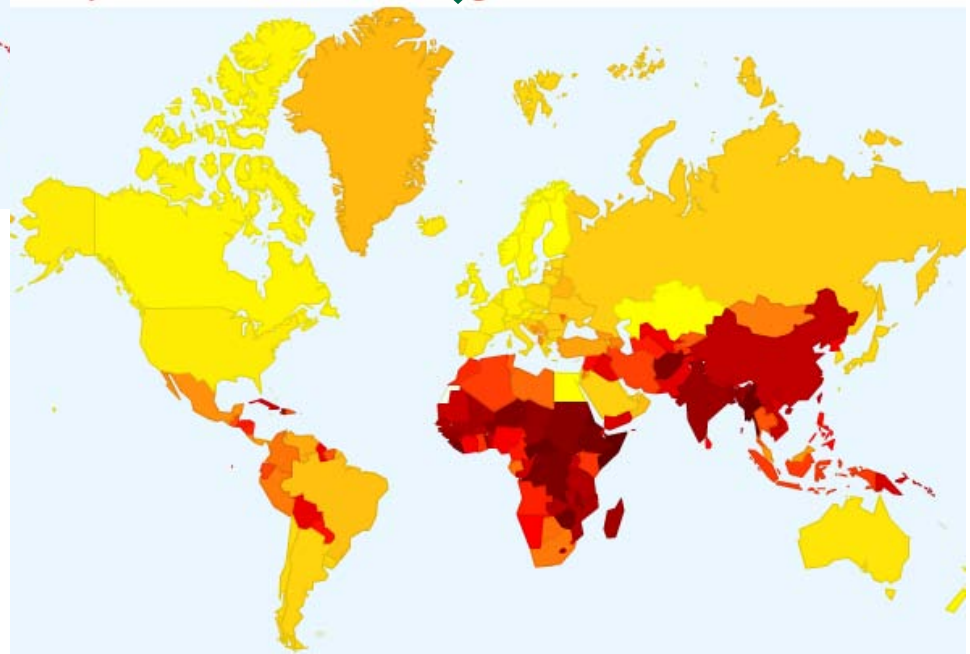
Source: Data from FAO 2012
Note: For Food Price Index 2002-2004=100

# High vulnerability to climate change, esp. in Asia and Africa




**Overall vulnerability:** Physical impacts adjusted for coping ability



**Direct risks:** Physical climate impacts

- Extreme Weather,
- Sea Level Rise,
- Agricultural Productivity Loss
- Overall

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Source: Wheeler 2011

# Towards an integrated approach to enhance global food and nutrition security

1. Accelerate investments in agric., esp. in smallholder productivity, improve nutrition, and increase resource-use efficiency

2. Scale-up productive social safety nets to protect poor and vulnerable groups

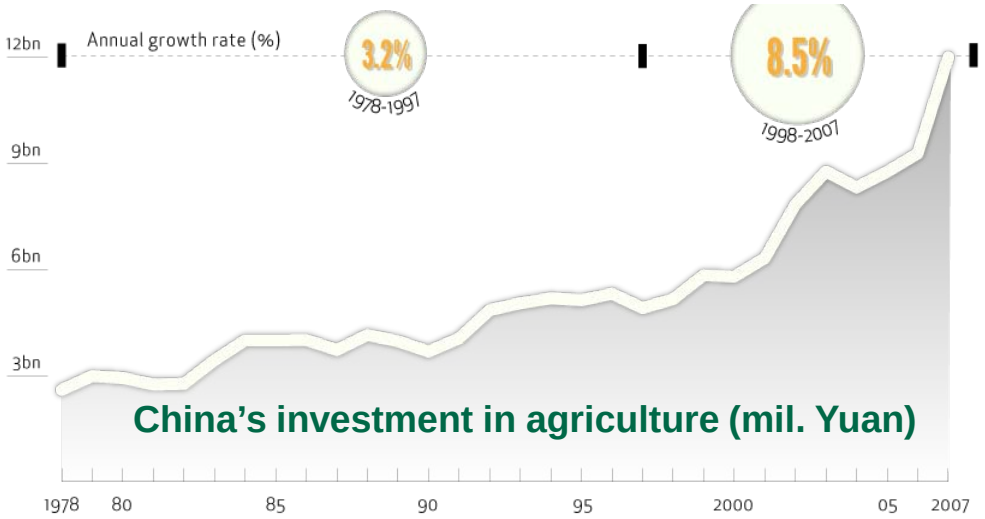
3. Improve global coordination to reduce food price volatility

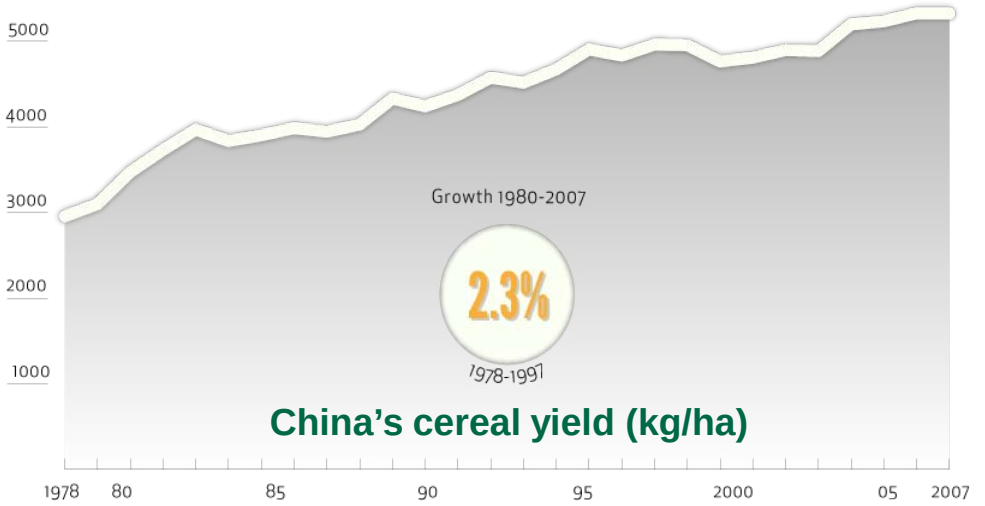
4. Invest in agric. climate change mitigation / adaptation and promote low-carbon agriculture

5. Support country policymaking capacity and enhance institutions and governance in agriculture and the food system

# 1a. Accelerate investments in agriculture, esp. smallholder productivity

- Invest in agric. R&D and rural infrastructure
- Improve access to inputs e.g. seeds and fertilizer
- Promote innovations
  - Financial services
    e.g. community banking
  - Risk management mechanisms
    e.g. weather-based index insurance
  - Institutional arrangements
    e.g. producer cooperatives

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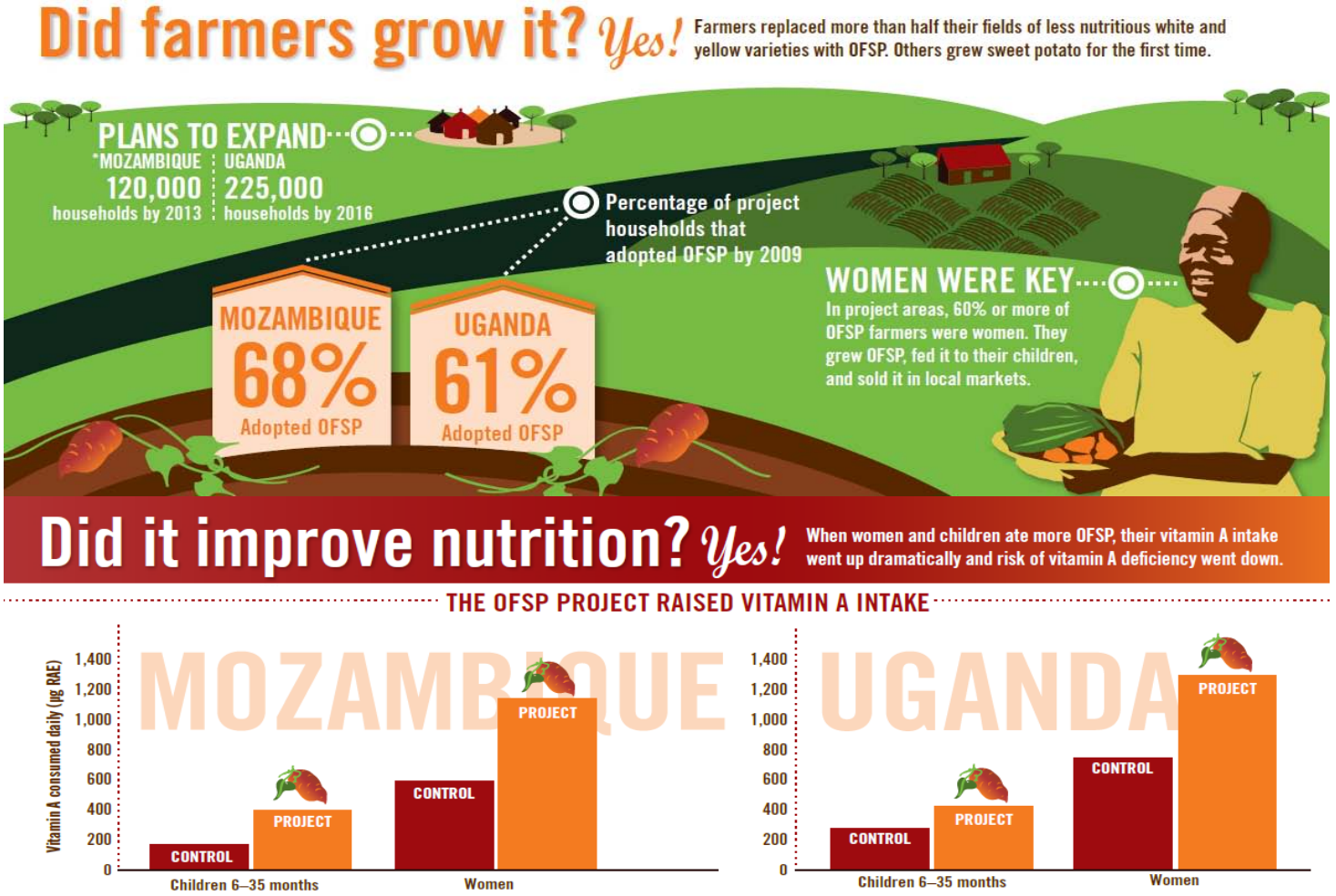
Source: Farming First 2012 with data from IFPRI; World Bank

# 1b. Leverage smallholder agriculture for better nutrition and health

## Biofortification: Improving vitamin A intake with orange-fleshed sweet potato

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Source: HarvestPlus 2012

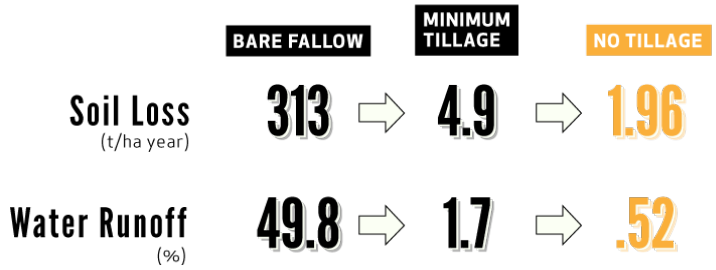
# 1c. Promote resource-efficient technologies and practices (high payoffs)

## Crop and water productivity gains from conventional to drip irrigation, India

| Crop | Change in yield (%) | Change in water use (%) | Water productivity (%) |
|---|---|---|---|
| Banana | +53 | -45 | +173 |
| Cabbage | +2 | -60 | +150 |
| Sugarcane | +39 | -60 | +205 |
| Sweet Potato | +39 | -60 | +243 |
| Tomato | +50 | -39 | +145 |

Source: Farming First 2012 with data from IWRA

## Conservation tillage gains, Ghana




Source: Farming First 2012 with data from FAO

Compared to "business as usual," sustainable water management can de-risk globally:

- **> 1 bil. people**
- **~ $17 tril. of GDP**
- **> 20% of children likely to suffer from malnutrition**
  (with higher investments in rural water supply and sanitation and female secondary education)

Source: Veolia Water and IFPRI 2011

# 2. Scale-up productive social safety nets

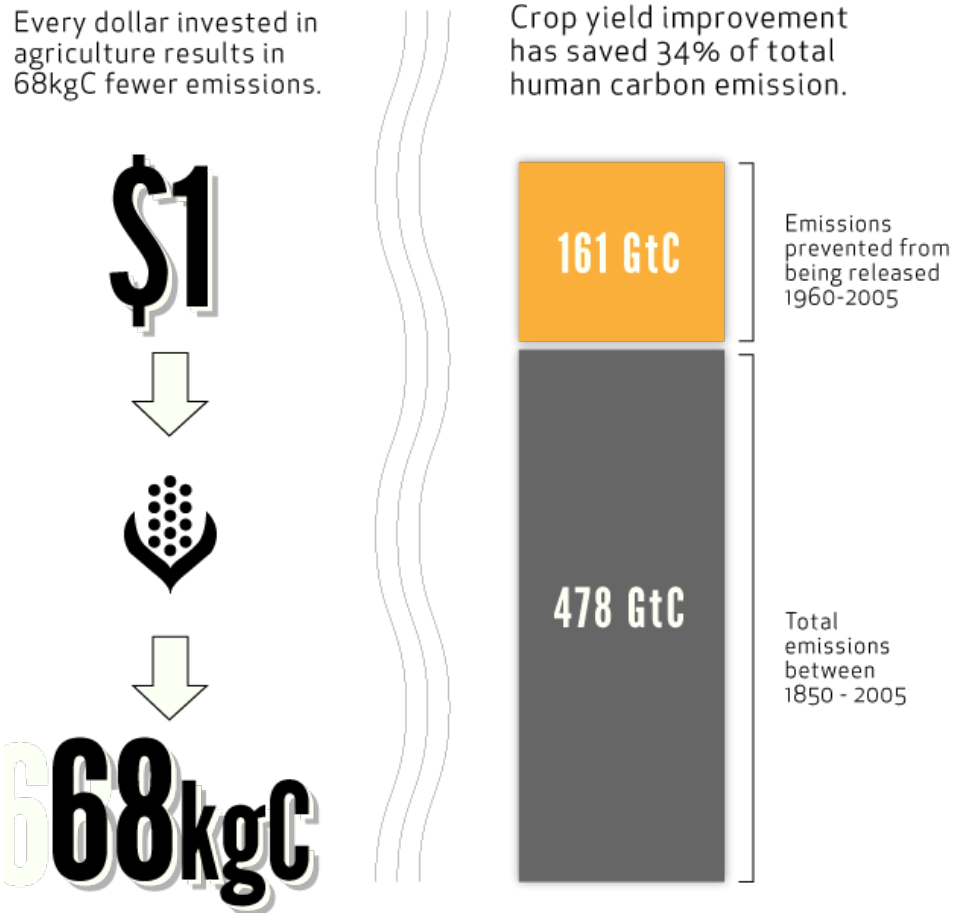
- Better-targeted and more productive social protection policies need to
  - secure basic livelihoods
  - protect poor people from risk and vulnerability

- Explore new approaches, e.g. cross-sectoral social protection, to reach poor more effectively
  - **Ethiopia Productive Safety Net Program (PSNP)**
    - Part of broad food security program
    - Access to both safety nets and ag. support more beneficial for ag. productivity and food security than stand alone programs (Gilligan, Hoddinott, and Taffesse 2009)

# 3. Improve global coordination to reduce food price volatility

- **Create global and regional grain reserves**
  - Located in poor food importing countries e.g. Horn of Africa
- **Support transparent and free global trade**
  - Eliminate harmful trade restrictions and prevent new ones
- **Minimize food-fuel competition**
  - Halt grain-based biofuel production
- **Monitor global food prices and speculation**
  - G-20's information system (AMIS) / IFPRI's Excessive Food Price Variability Early Warning System

# 4a. Invest in agric. climate change mitigation / adaptation




Source: Farming First 2012 with data from Burney et al. 2010

Agricultural investments should target measures that provide **productivity mitigation, and adaptation, benefits** (Bryan et al. 2011)

At least additional **US$7 bil. agricultural productivity investments** are needed annually to offset adverse effects on human well-being (Nelson et al. 2009)

# 4b. Promote low carbon agriculture

## "triple wins" - productivity, adaptation, mitigation

**Synergies between productivity, climate change adaptation, and GHG mitigation, Kenya**

| CROP MANAGEMENT PRACTICE | PRODUCTIVITY IMPACTS | ADAPTATION BENEFITS | GHG MITIGATION POTENTIAL |
|---|---|---|---|
| **Improved crop varieties or types** | Increased crop yields & reduced yield variability | Increased resilience against climate change | Increased soil carbon storage |
| **Improved crop rotation/fallowing/ rotation with legumes** | Increased soil fertility & yields due to nitrogen fixing in soils | Improved soil fertility & water holding capacity increases resilience to climate change | High mitigation potential, esp. crop rotation with legumes |
| **Use of cover crops** | Increased yields due to erosion control & reduced nutrient leaching | Improved soil fertility & water holding capacity increases resilience | High mitigation potential through increased soil carbon sequestration |
| **Appropriate use of fertilizer and manure** | Higher yields | Improved productivity increases resilience to climate change | High mitigation potential, esp. where fertilizer has been underutilized |



Source: Bryan et al. 2011

# 5. Support country policymaking capacity

- Policies should come from developing countries to maximize local impact of global agenda
- Improve evidence on what policies have and have not worked
  - *Small-scale, local experimentation* followed by gradual implementation, e.g. China and Vietnam
  - Impartial monitoring of experiments

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**Country-owned policies should be continually tried, evaluated, adjusted, and tried again before being scaled up**

# Australia has an active role to play

- Australia has long played an active role to play in advancing global food and nutrition security, e.g.
  - AusAID, ACIAR, ANU…
  - Sir John Crawford—served as an architect of the CGIAR and first-ever board chairman of IFPRI
- Exploit large knowledge-base
  - Capacity building and knowledge sharing with developing countries
- Engage in broader, innovative, and productive partnerships

# In conclusion

- Malthus's prediction has not materialized thus far due to technological, institutional, and policy innovations
- Global agricultural output growth has been steady and is now productivity driven, but uneven across regions
- Current and future global food and nutrition challenges are large
- An integrated approach is needed to enhance global food and nutrition security and free the world of Malthus's shadow
- Australia has an active role to play