

Will We Run out of Natural Resources Needed for Food Production?



Dominique van der Mensbrugghe
Global Perspectives Studies Team
The Food and Agriculture Organization
of the United Nations (FAO)



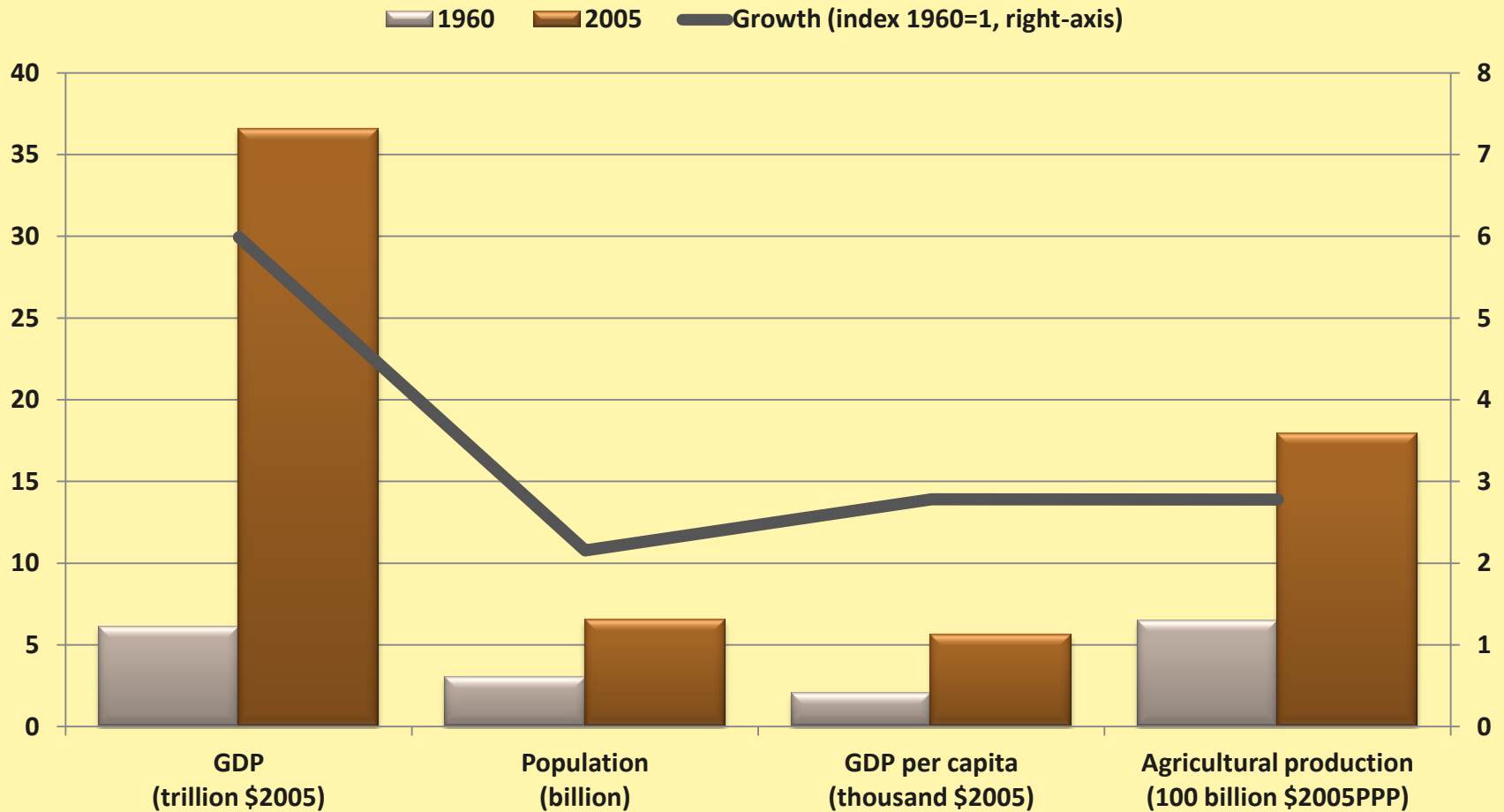
Public Lecture Series 2012-2014—Grand Challenges for Food and Agriculture
Agriculture and Food Development Authority (Teagasc) and the Royal Dublin Society
Tuesday, 27th November 2012, Royal Dublin Society, Dublin



Key messages

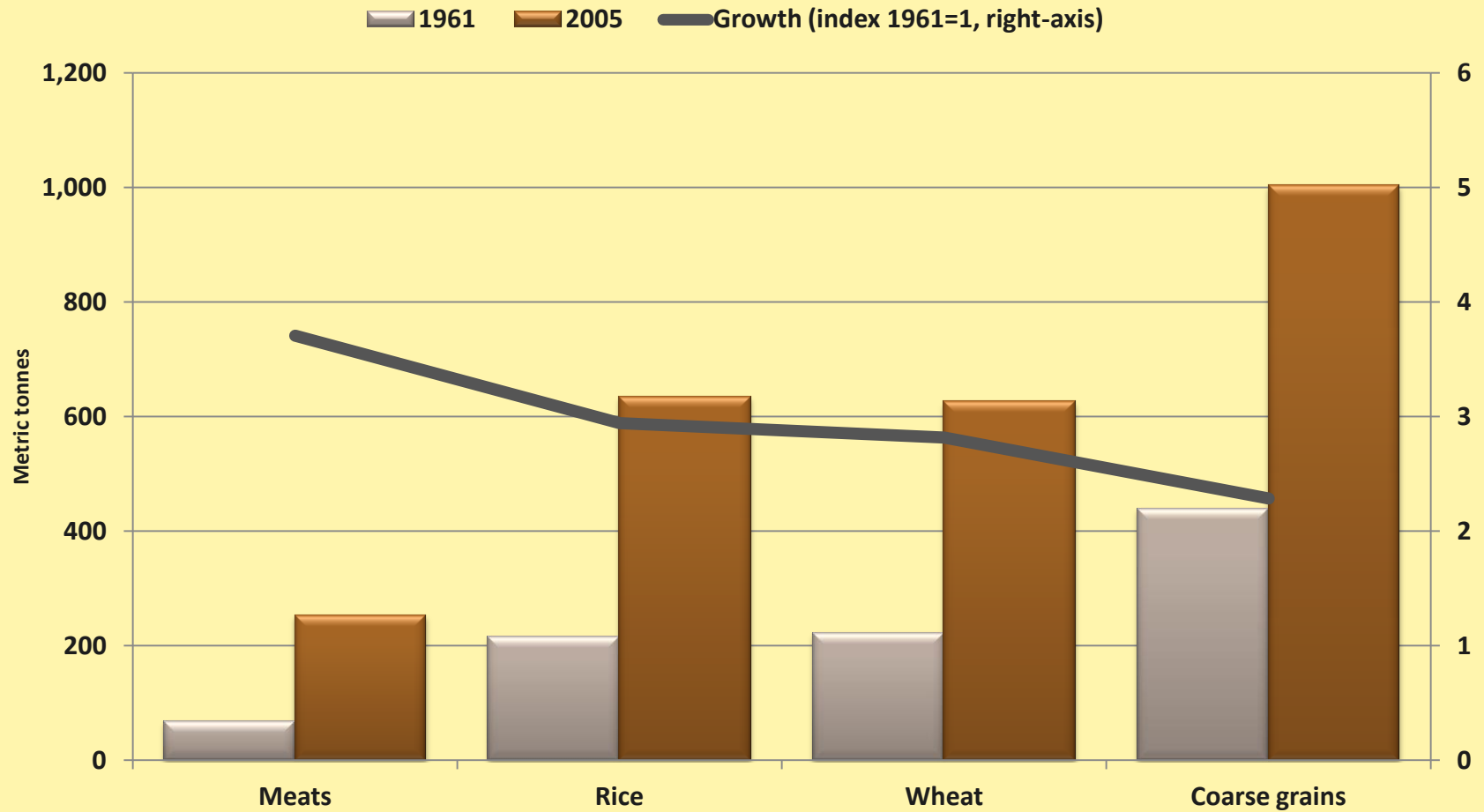
- **Fifty years of substantial progress, but**
 - Significant pockets of poverty and under-nourishment
 - Areas of unsustainable farm practices
- **Next 50 years appear less daunting**
 - Declining population growth and reaching food saturation thresholds,
 - Albeit with continued large pockets of poverty and continued concerns with sustainability
- **However, new issues emerge:**
 - Climate change
 - Bio-energy

Substantial progress at global level over last 45 years



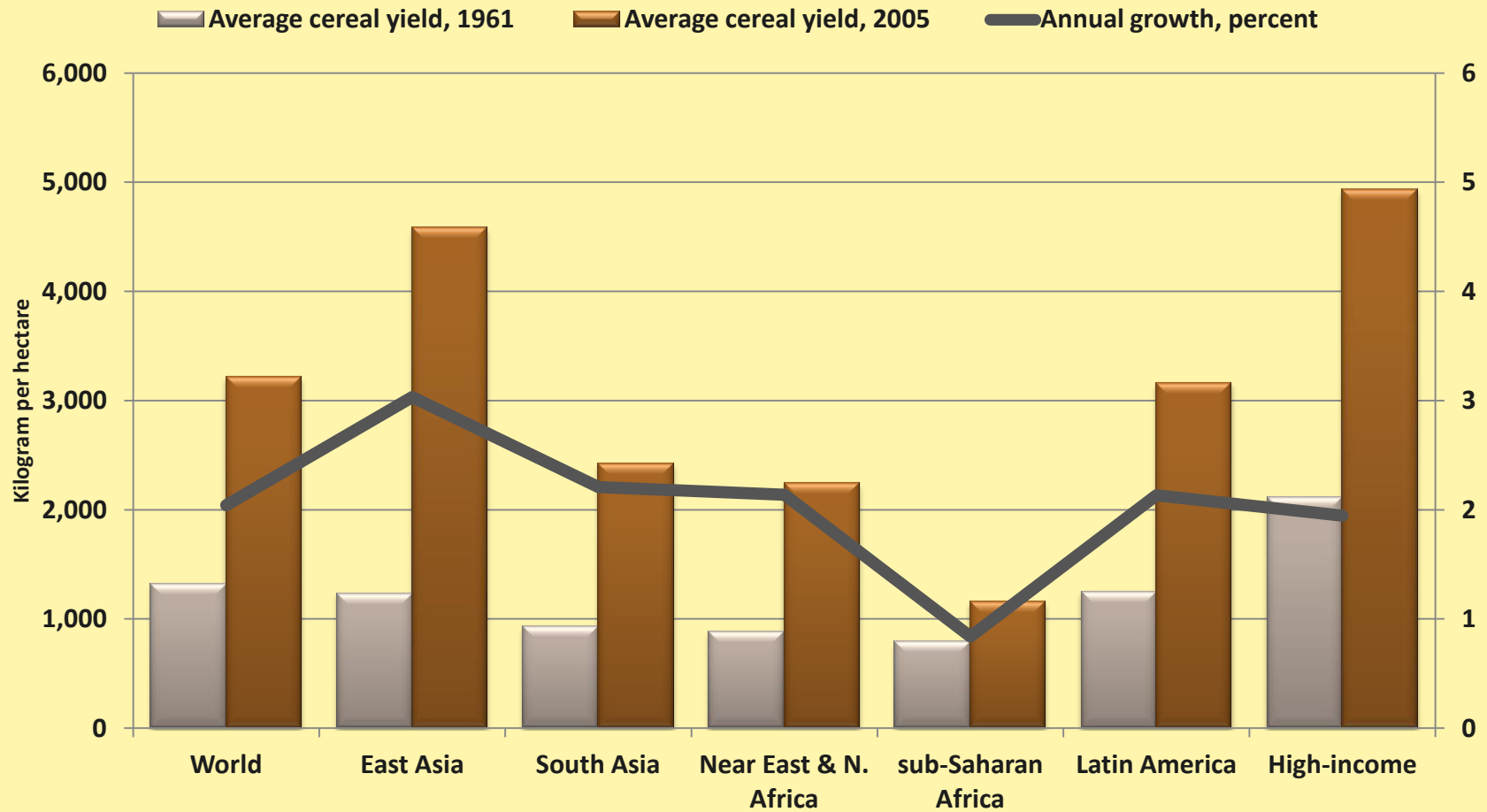
Source: World Bank (GDP), UN Population Division (population), FAO (agricultural production).

Large quantity changes for major commodities



Source: FAO.

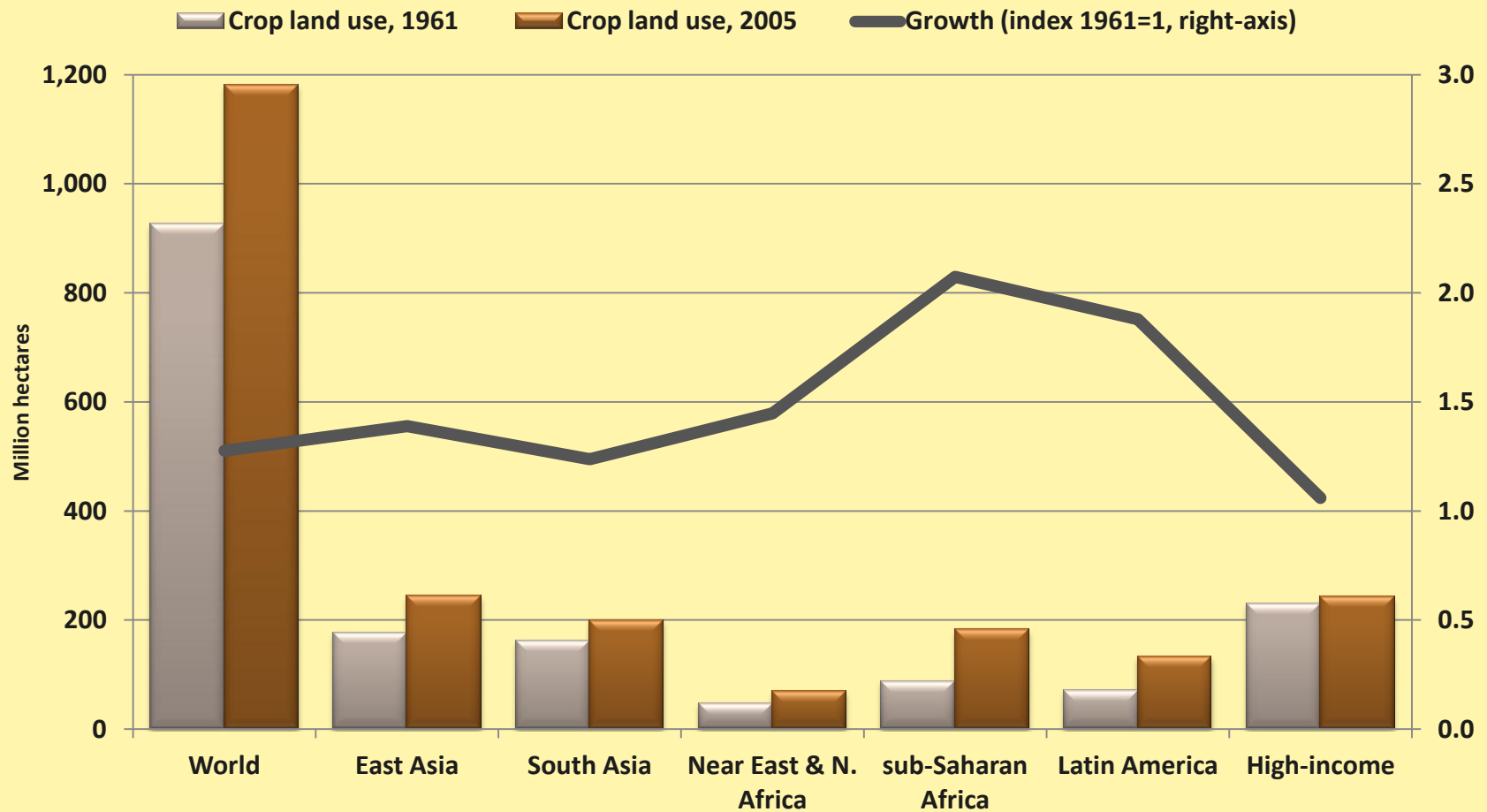
Yield improvements account for over 70 percent of production growth



Source: FAO.



Global land expansion for crops of around 250 million hectares



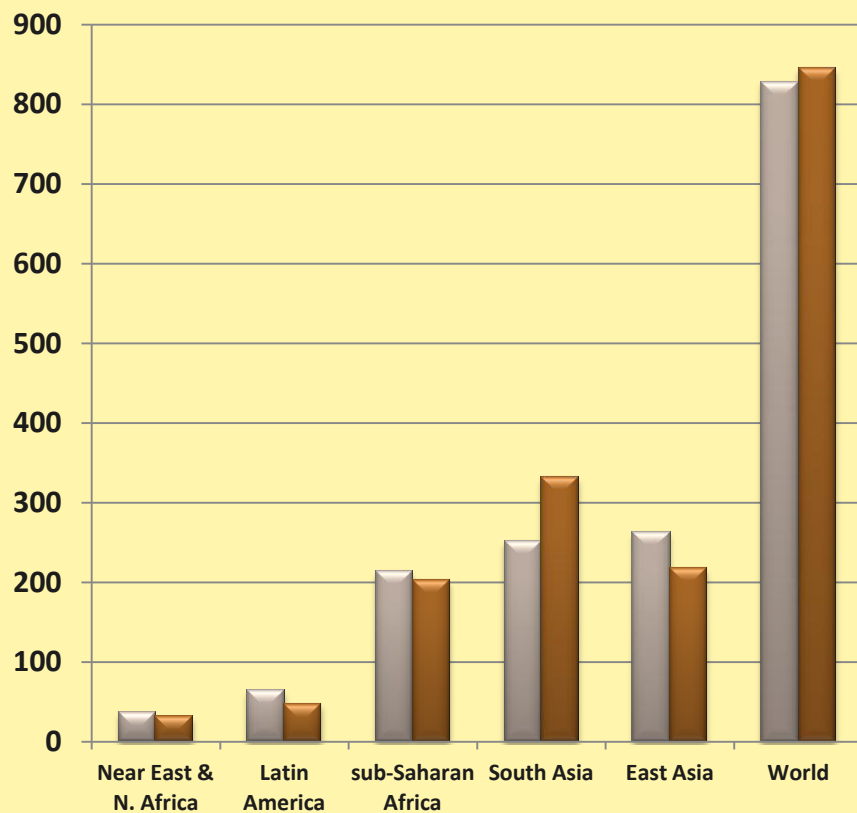
Source: FAO.



Modest progress in under-nourishment

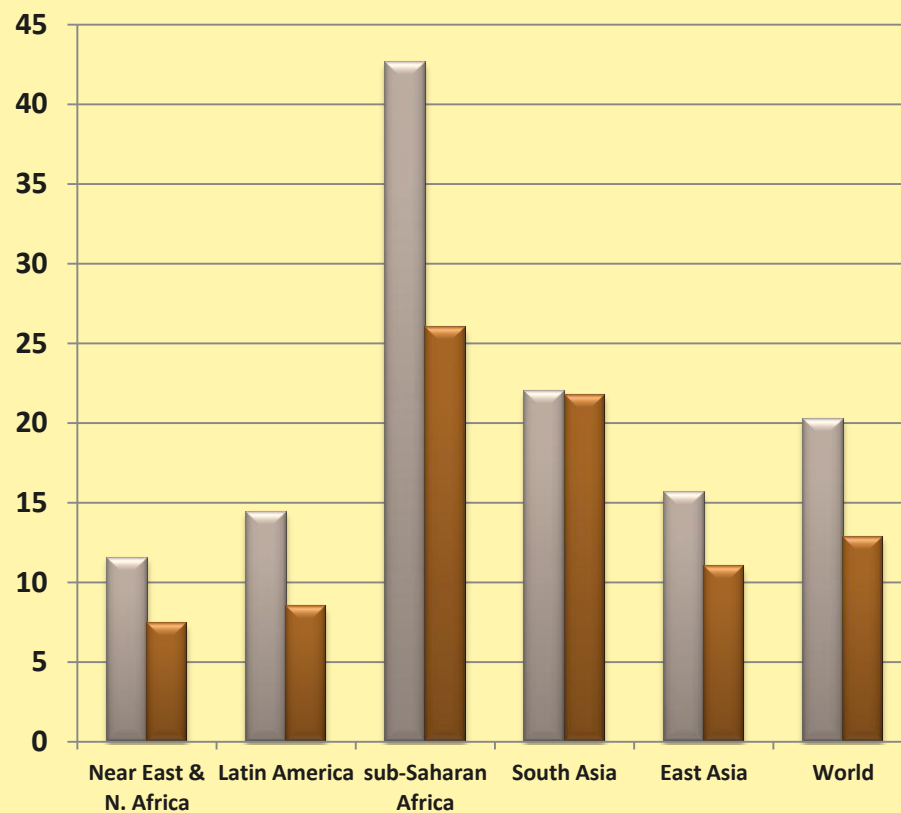
Number of undernourished, million

1991 2006



Percent of population undernourished

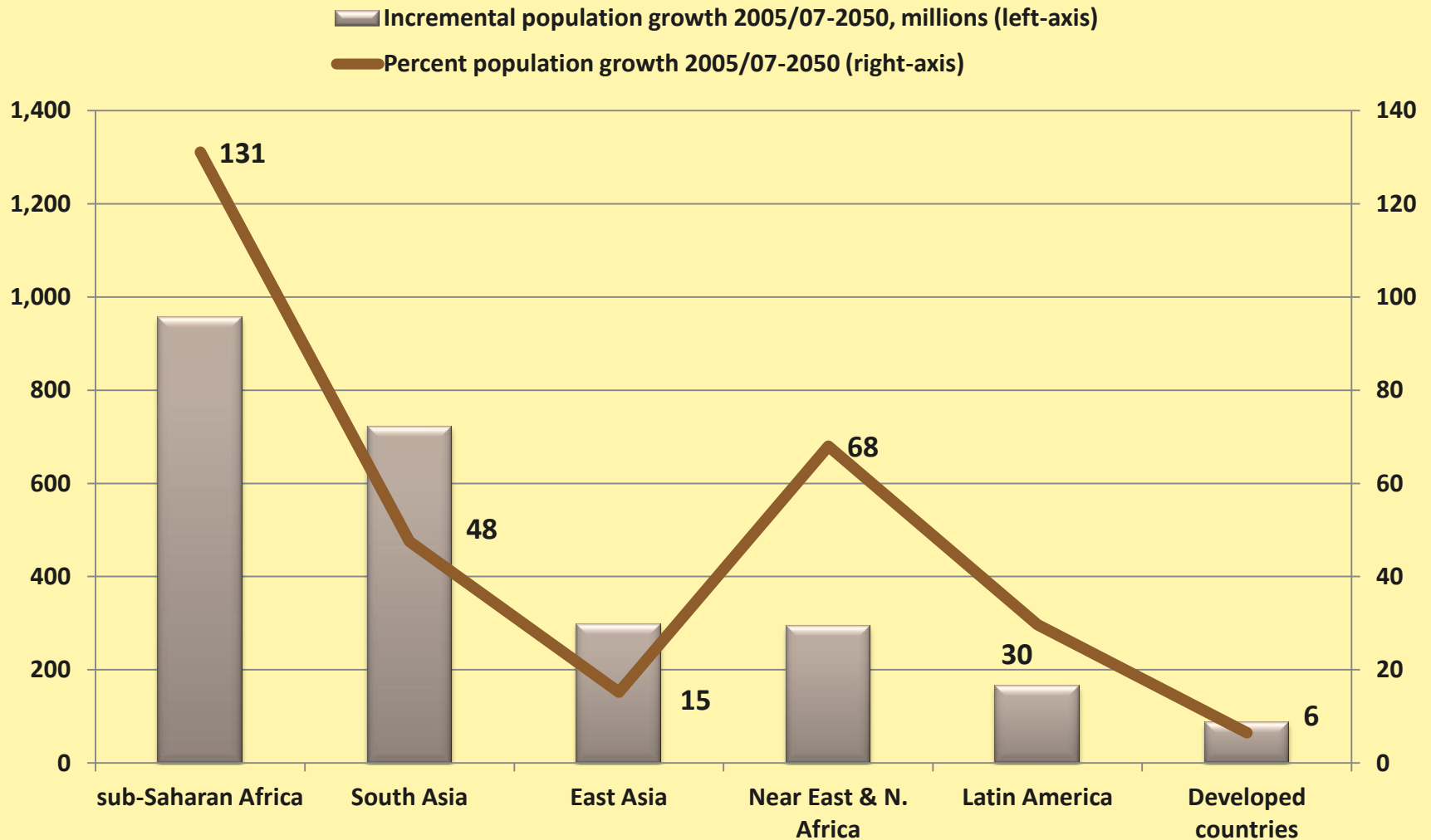
1991 2006



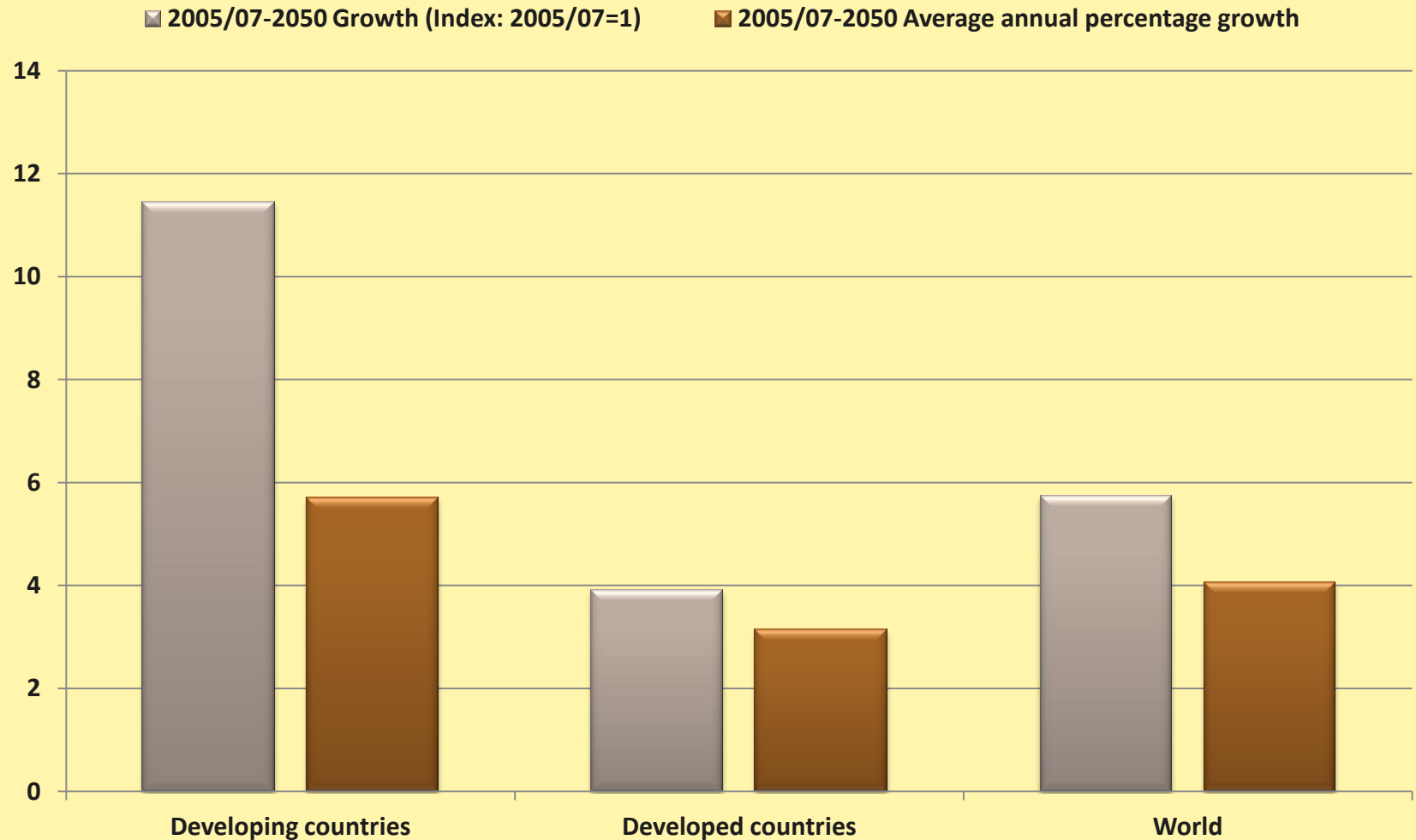


Looking forward...

An additional 2.5 billion persons—to 9.1 billion in 2050

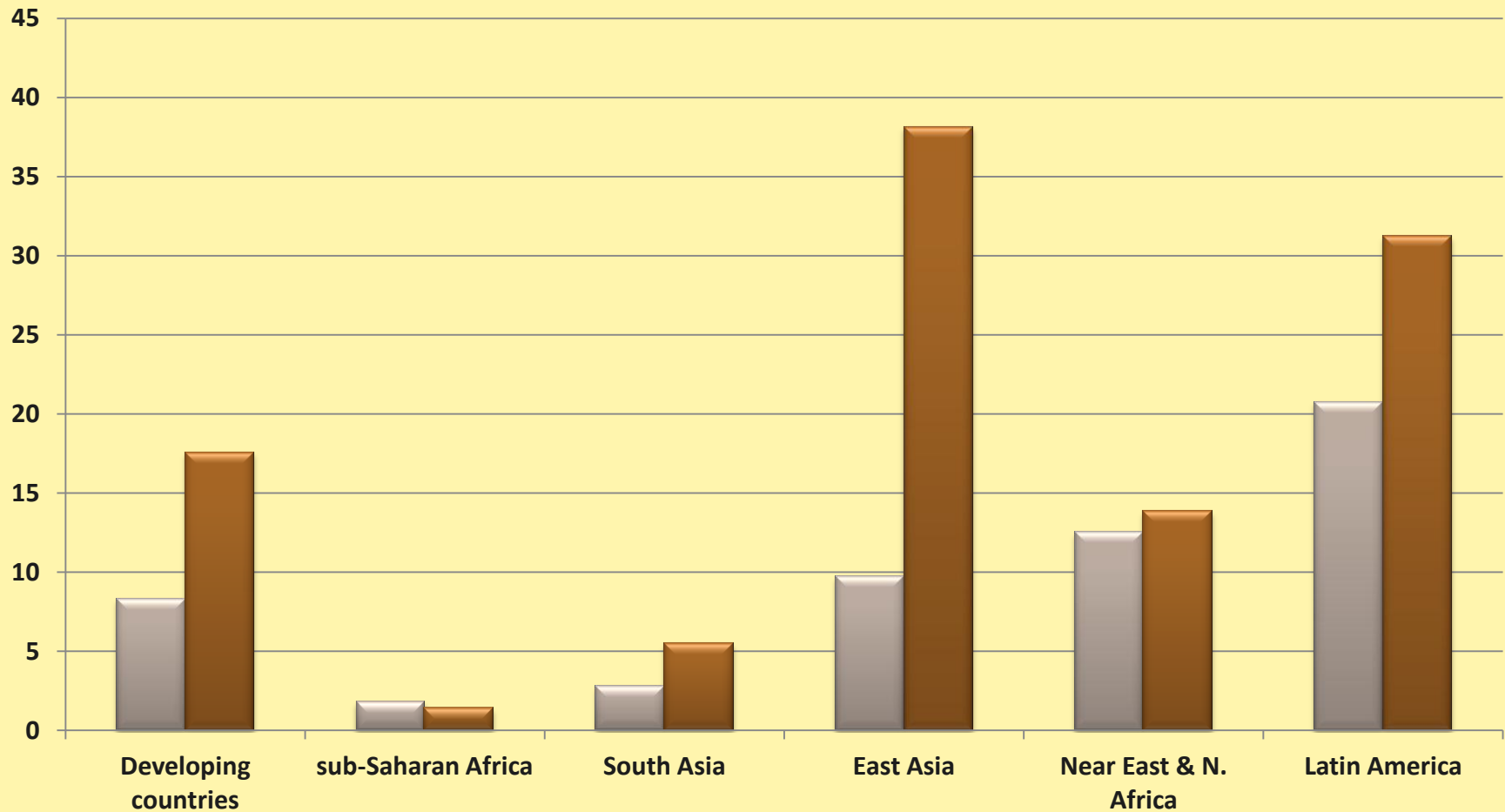


Strong rotation in global output towards developing countries...



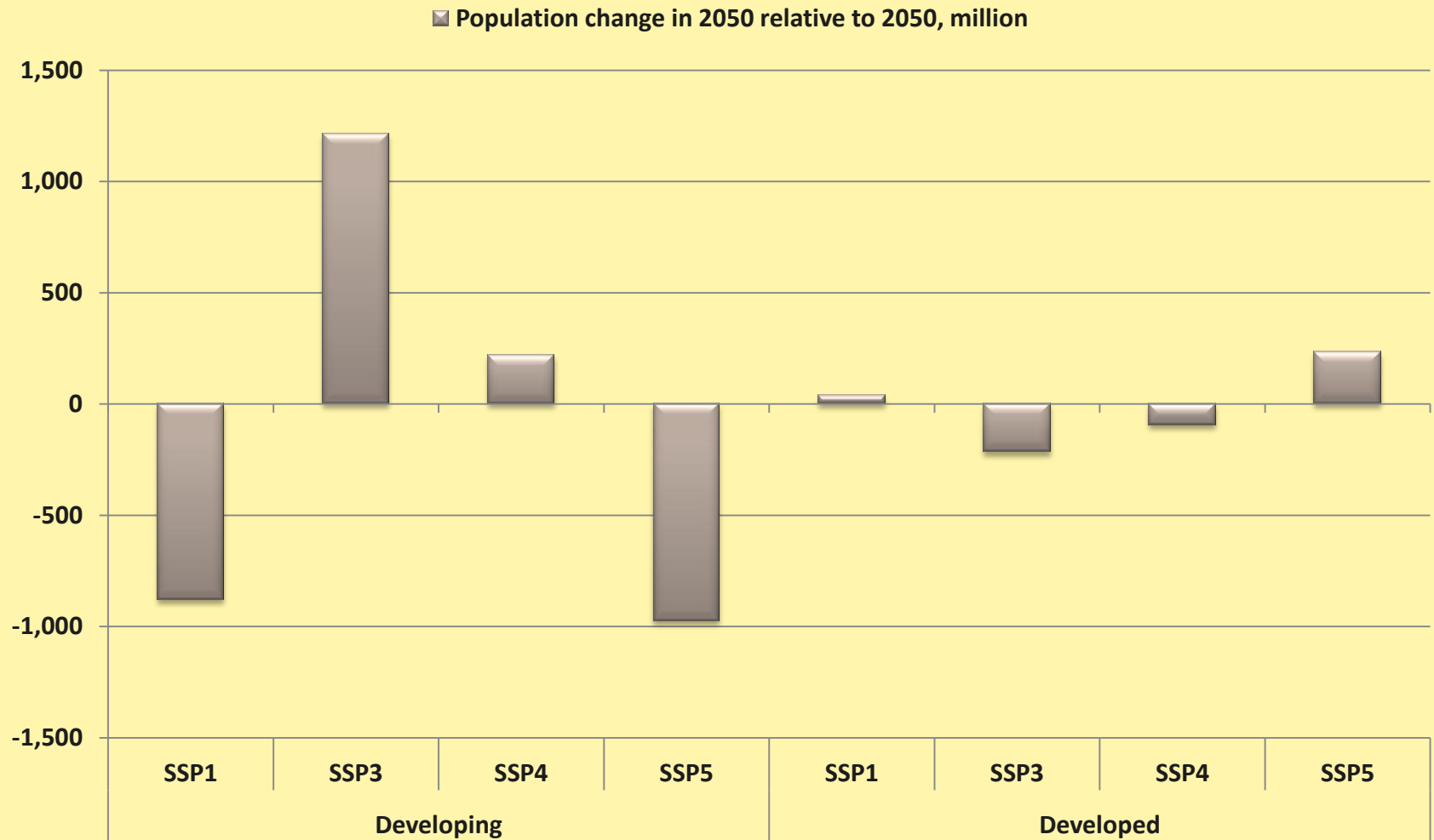
...yet only modest convergence in incomes

■ Average per capita incomes relative to developed countries 2006, percent
■ Average per capita incomes relative to developed countries 2050, percent





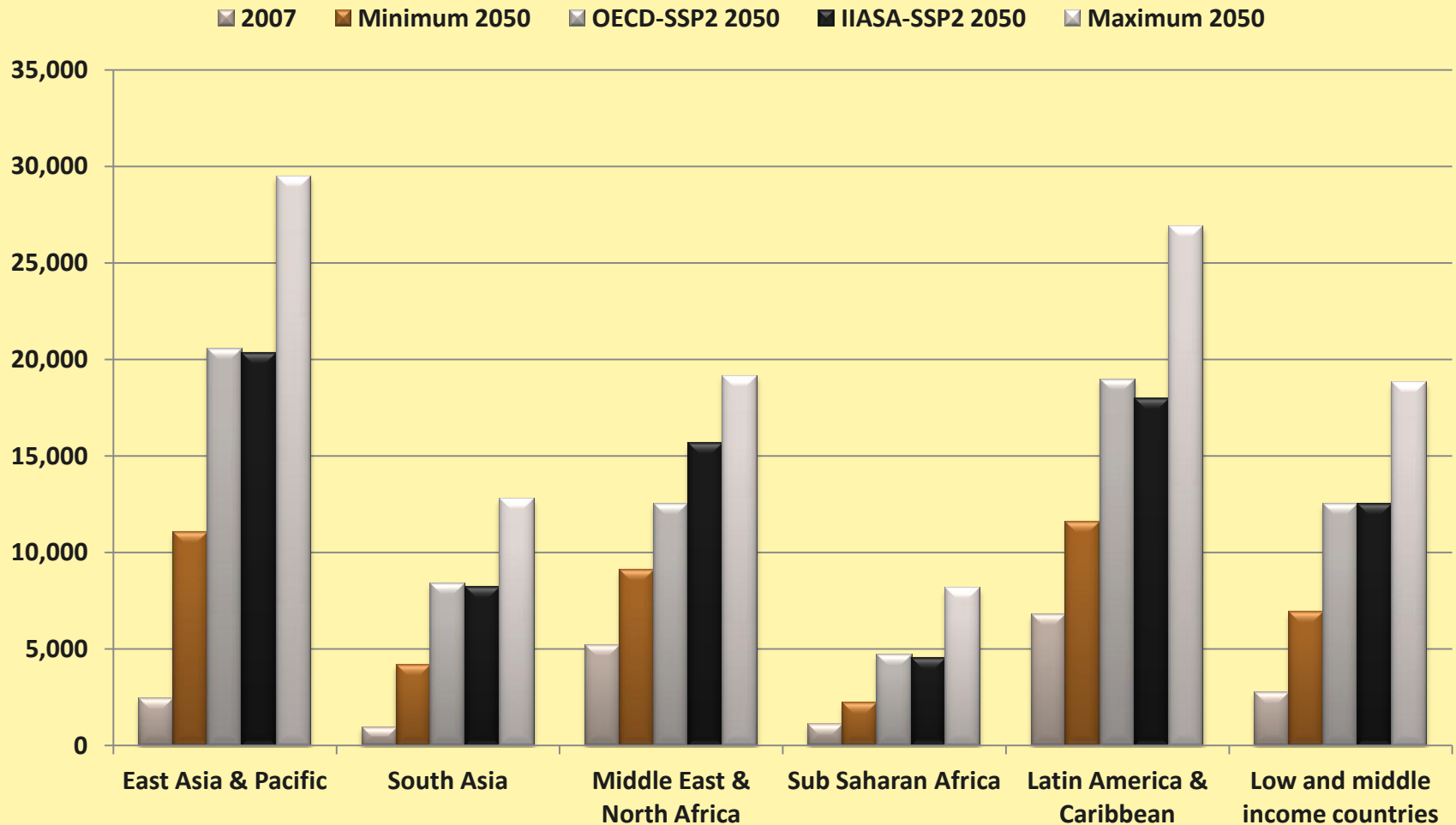
Projection of drivers subject to considerable uncertainties...



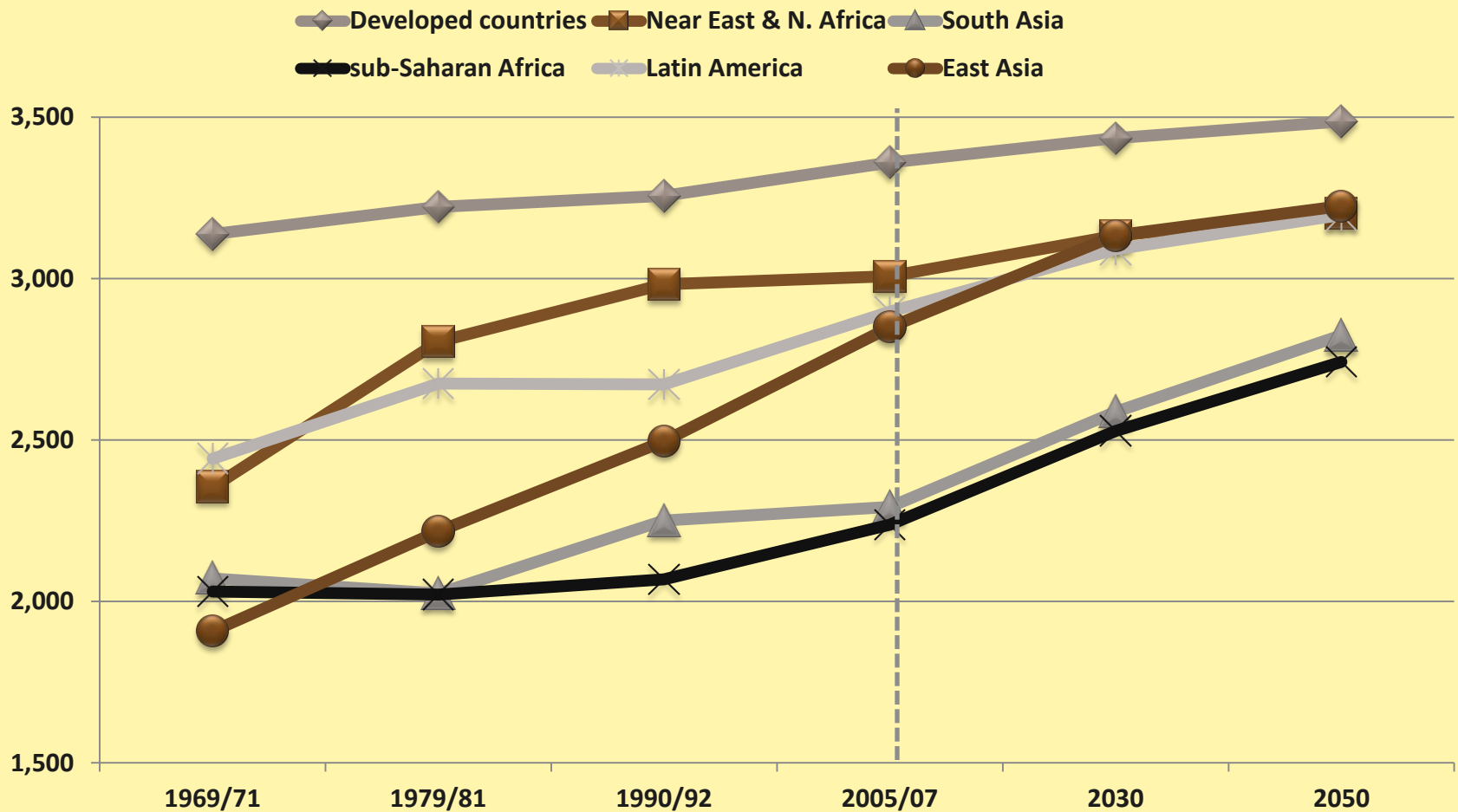
Note: Shared socio-economic pathways (SSP) are scenarios currently under development by the scientific community in the context of climate change. SSP2 is often considered a middling or business-as-usual scenario.

...with implications for food demand, income distribution and poverty

Income range per capita in 2007 and 2050 under various SSP scenarios, \$2007



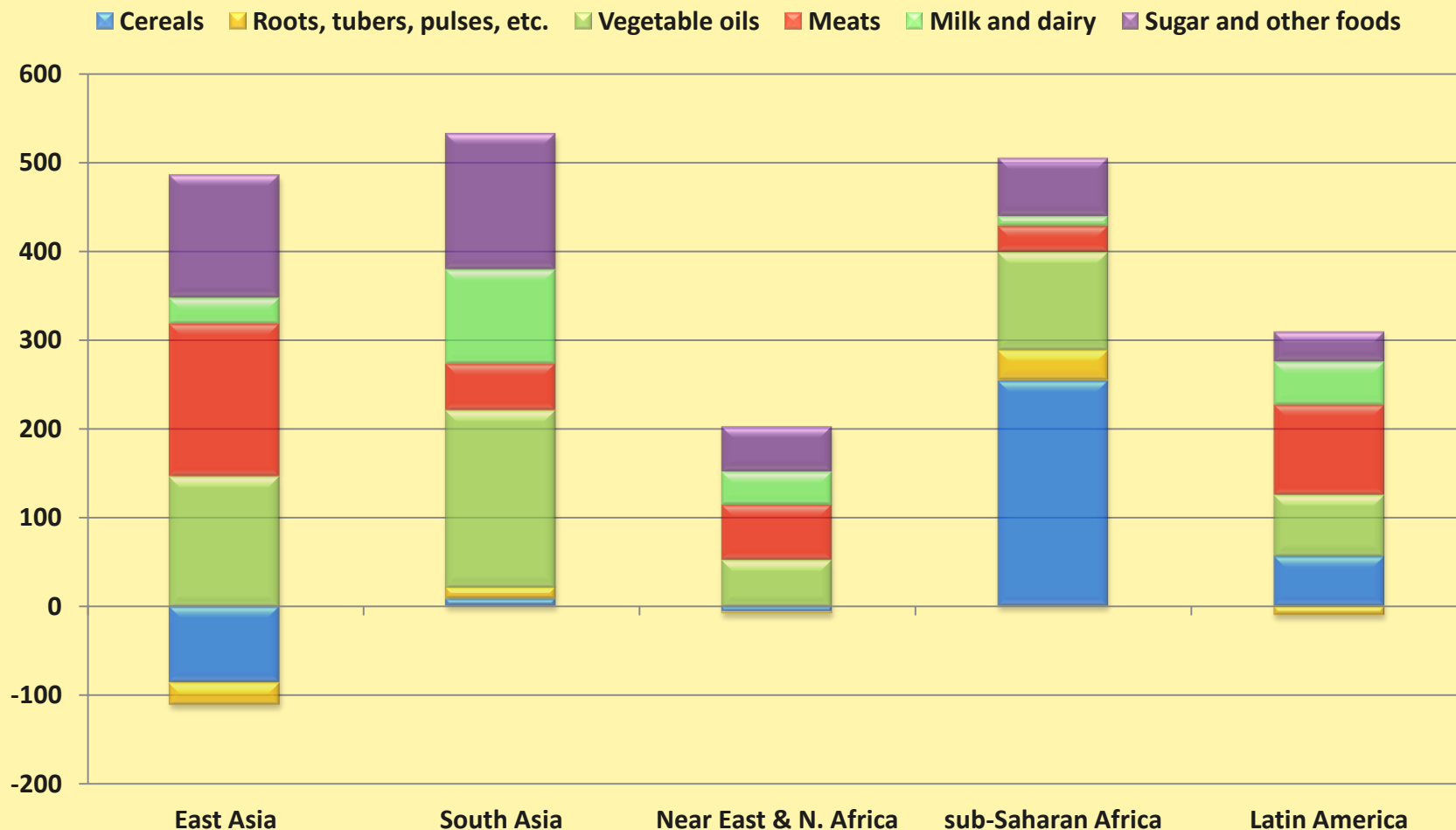
Converging caloric intake, kcal/person/day





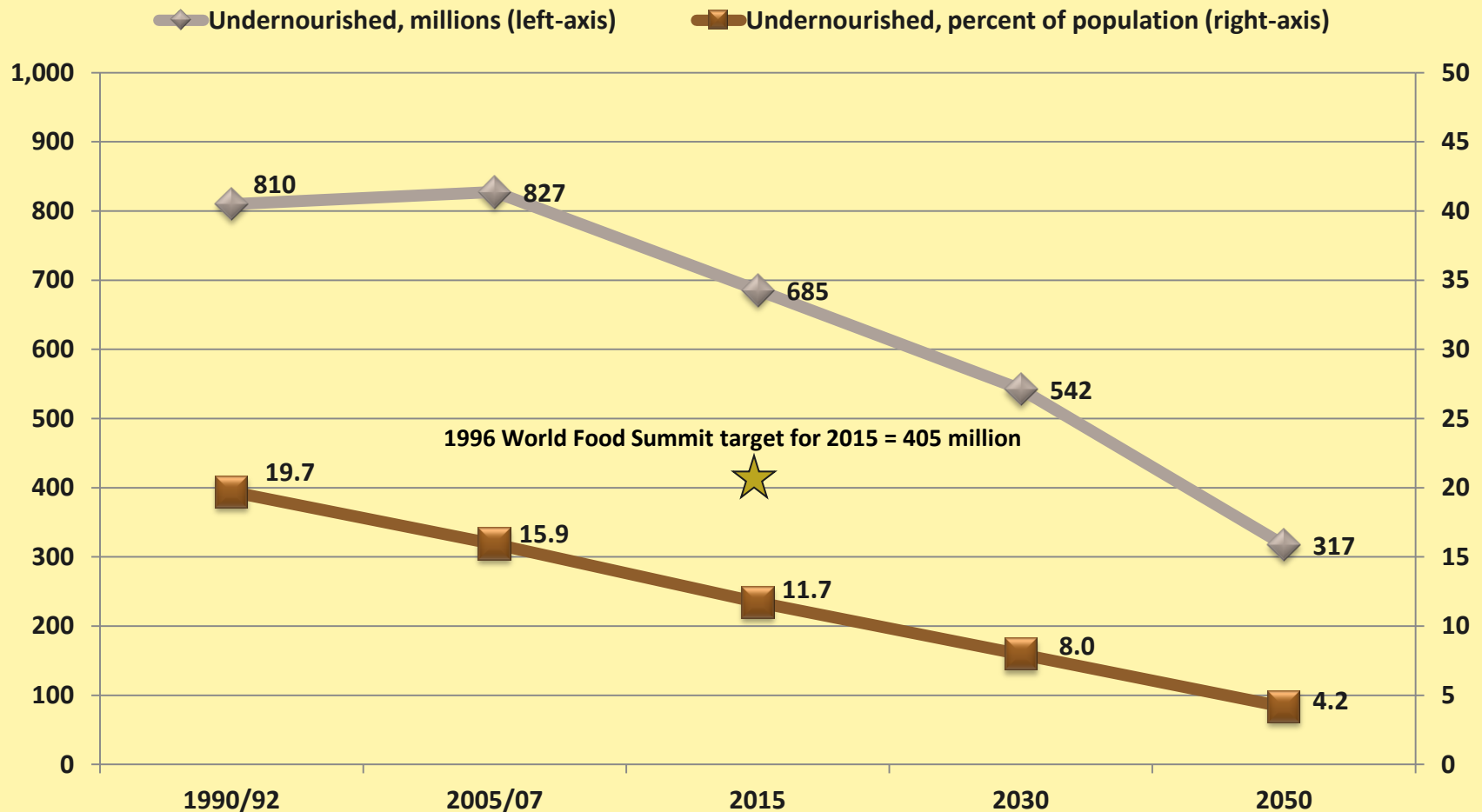
Shift towards meats and vegetable oils, cereals in SSA

Change in daily caloric intake between 2005/07 and 2050, kcal/person/day





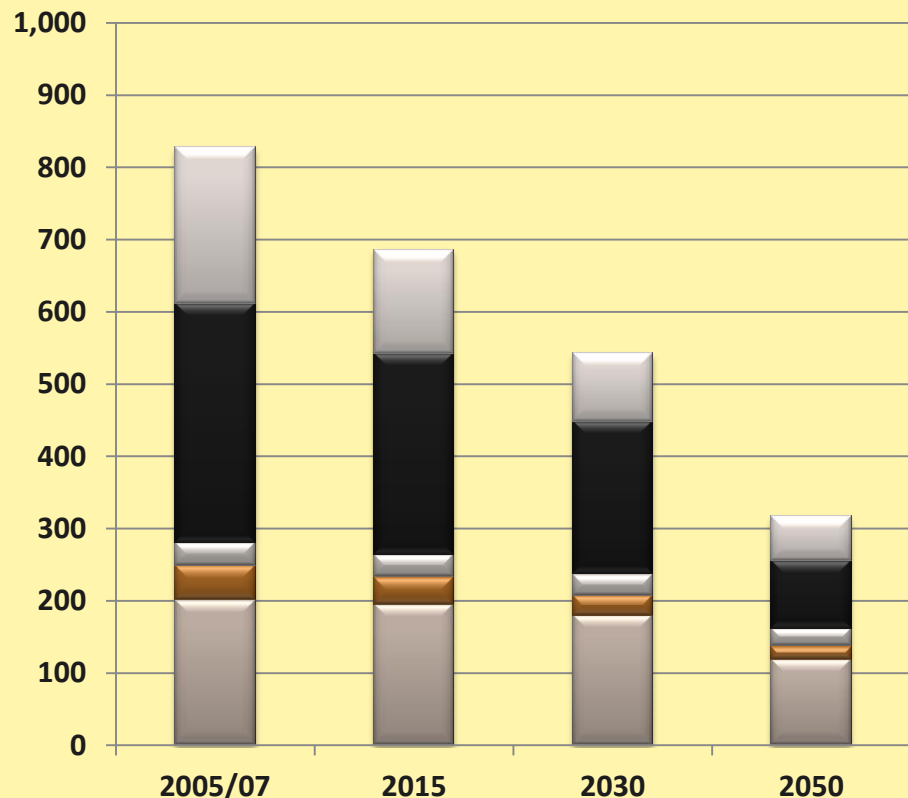
Undernourishment target unlikely to be achieved until after 2030



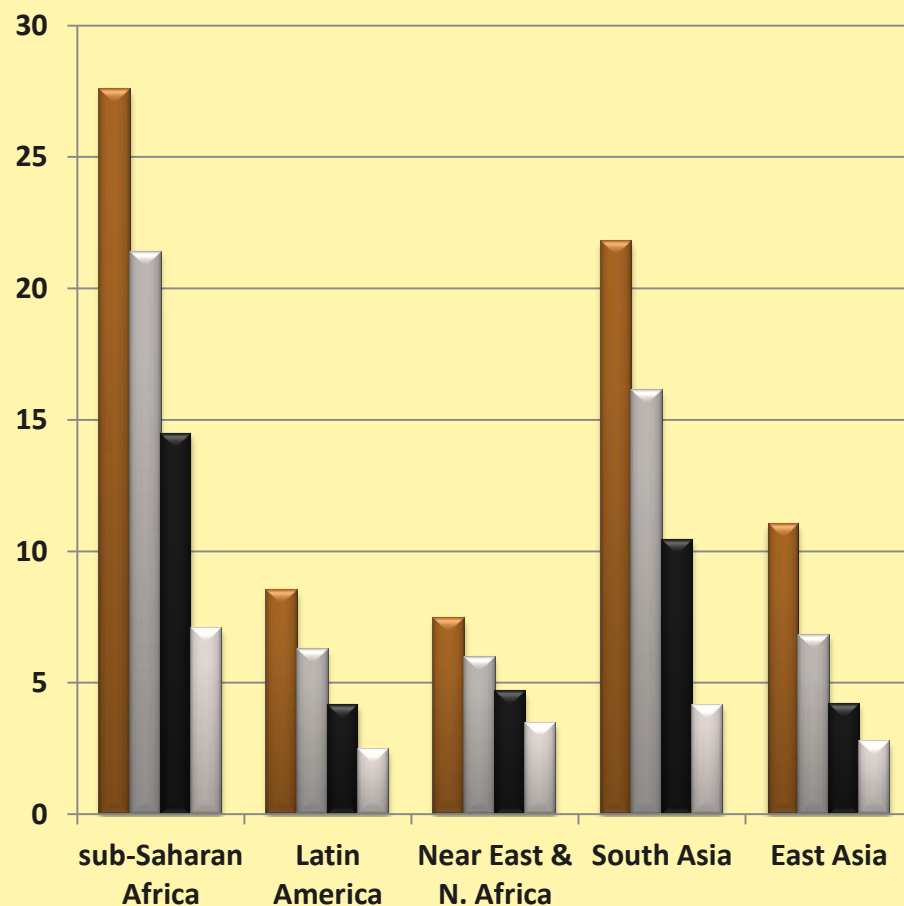


Increasing concentration of under-nourished in SSA and South Asia

sub-Saharan Africa Latin America
Near East & N. Africa South Asia
East Asia

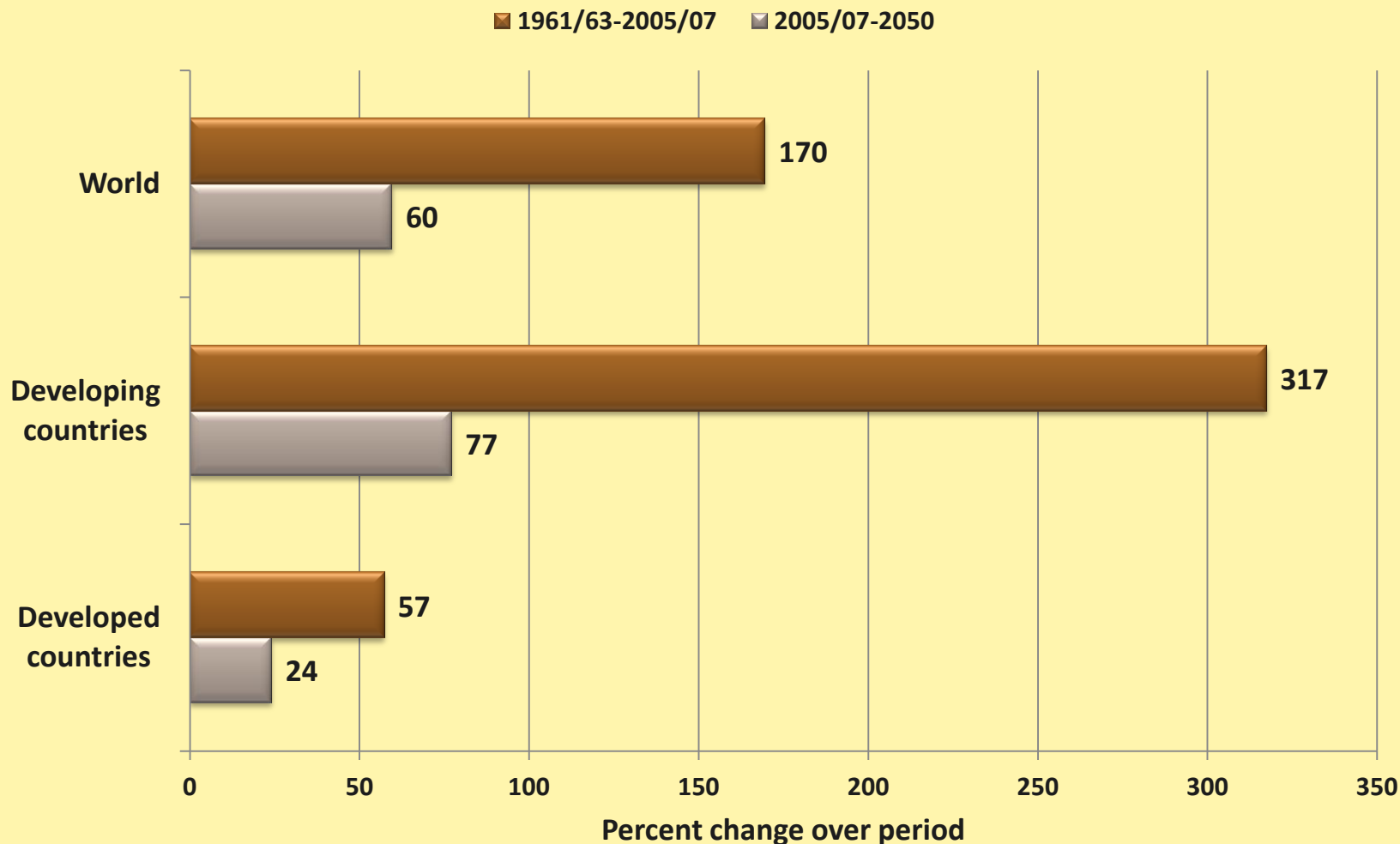


2005/07 2015 2030 2050



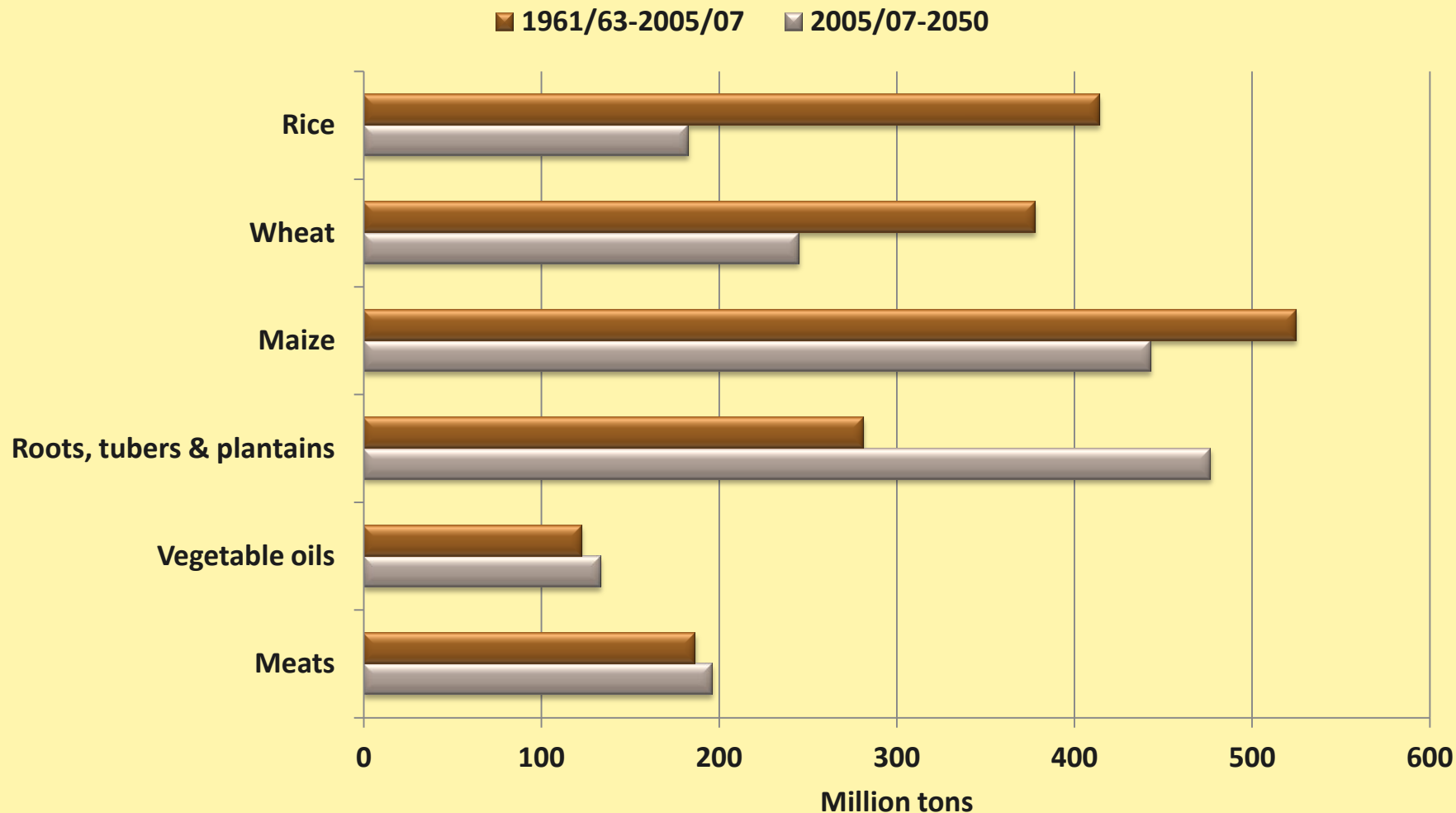


Sharp deceleration in agricultural production compared to past



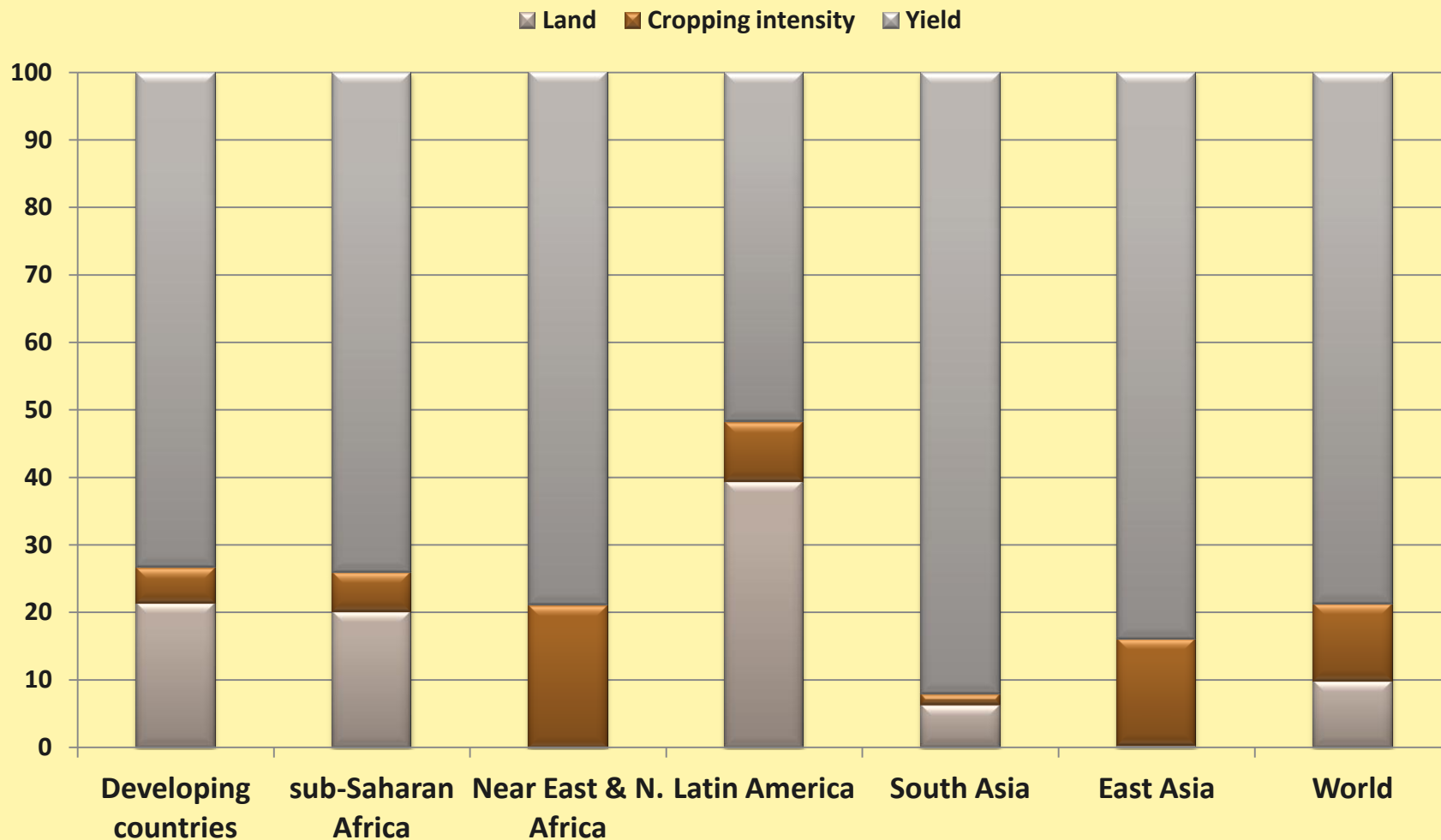


Despite deceleration, volume increase is sizeable...



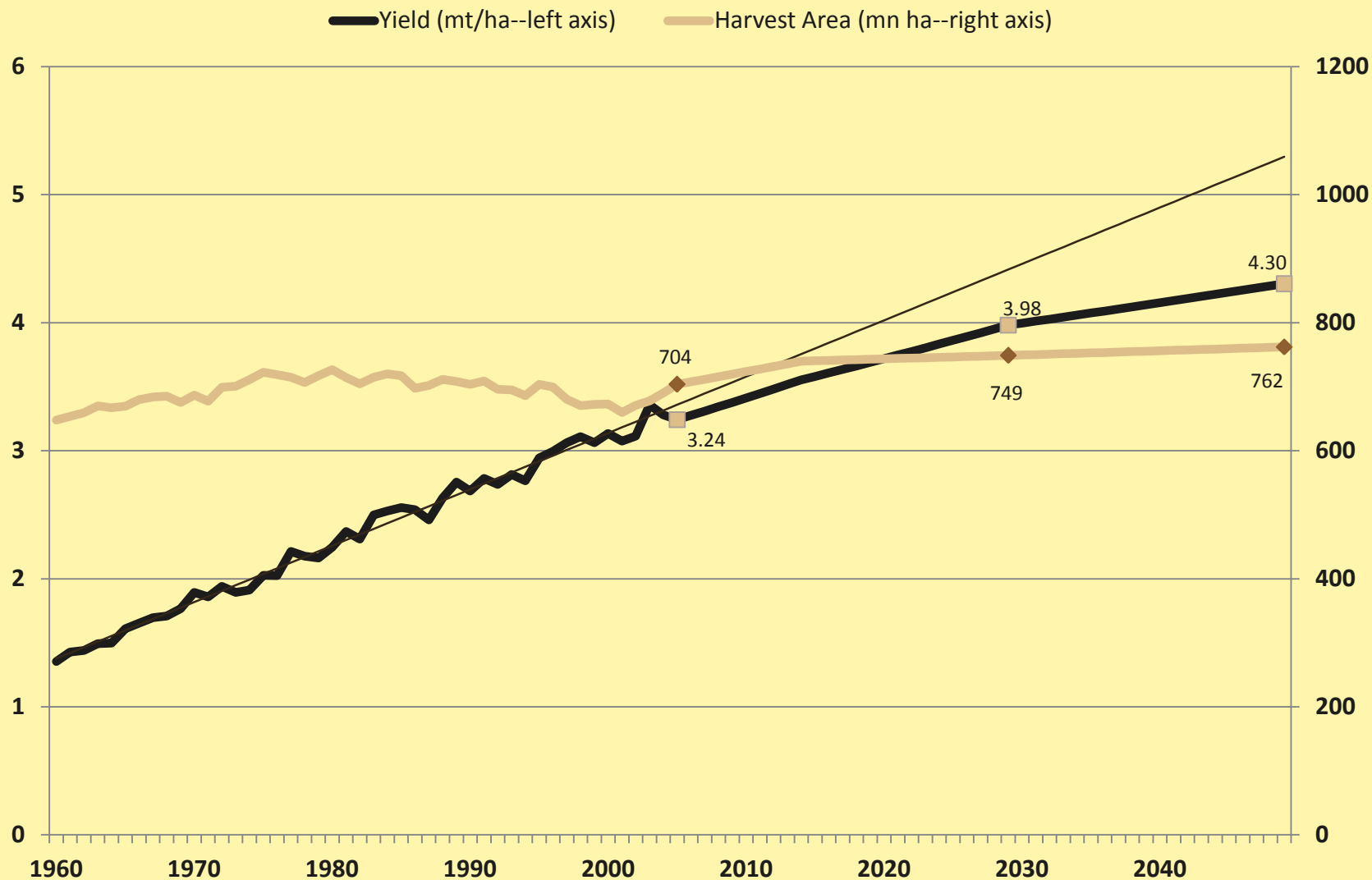


Yield growth will contribute 80% of projected production growth



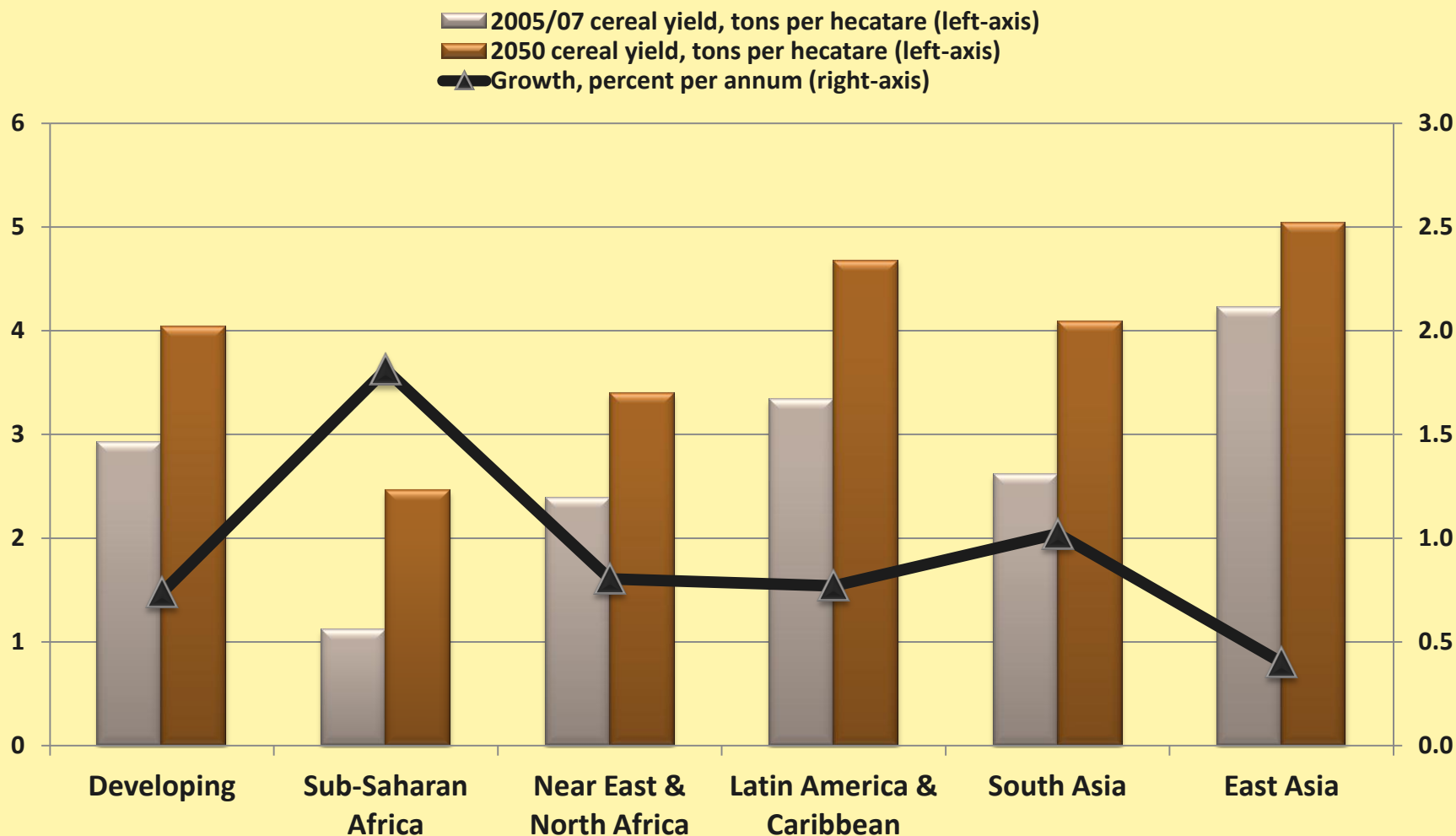


Could yield growth be higher with more devoted to R & D?

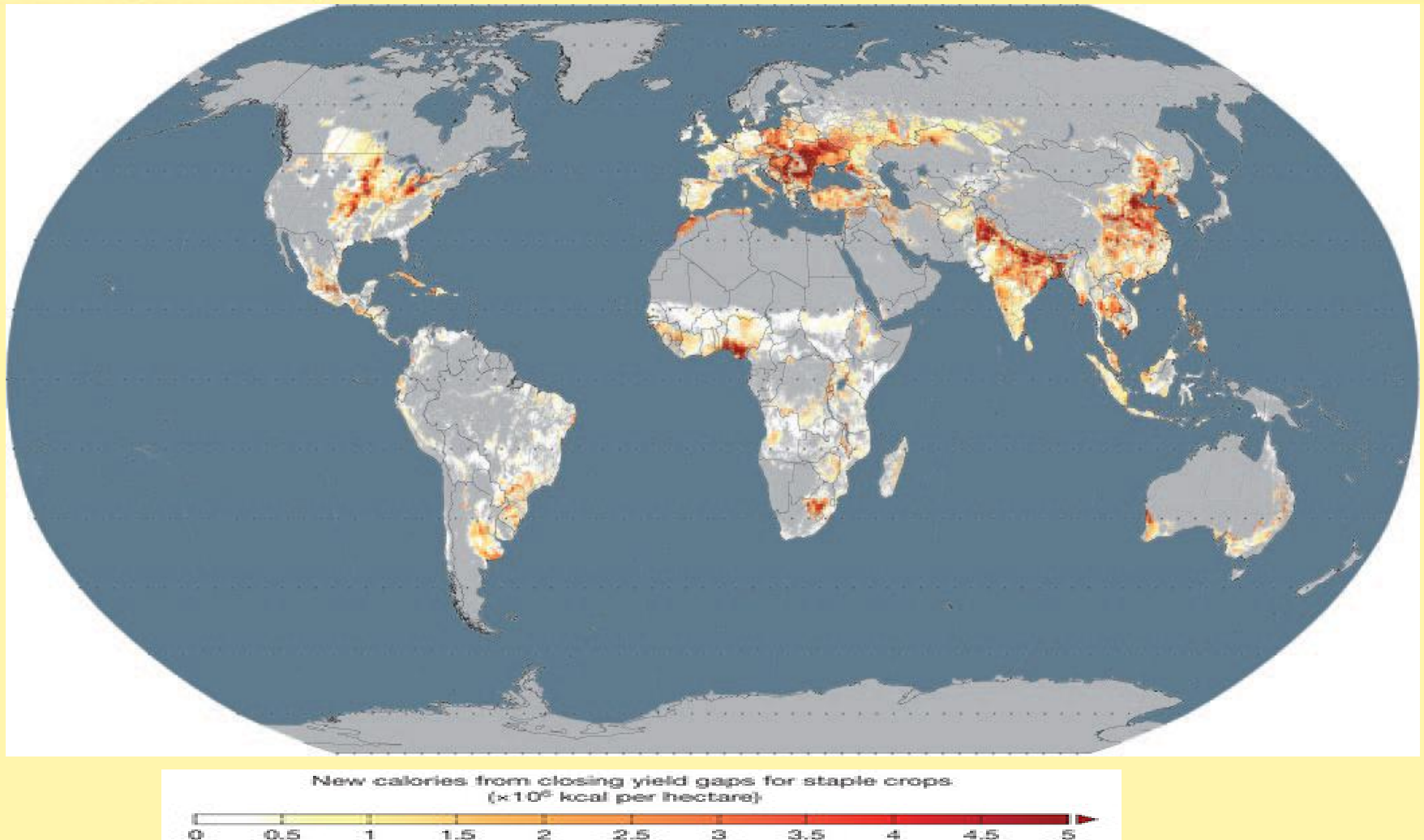




Sharp regional yield differences in initial levels and future growth



Closing yield gaps of 16 crops could yield a 58% increase in calories produced

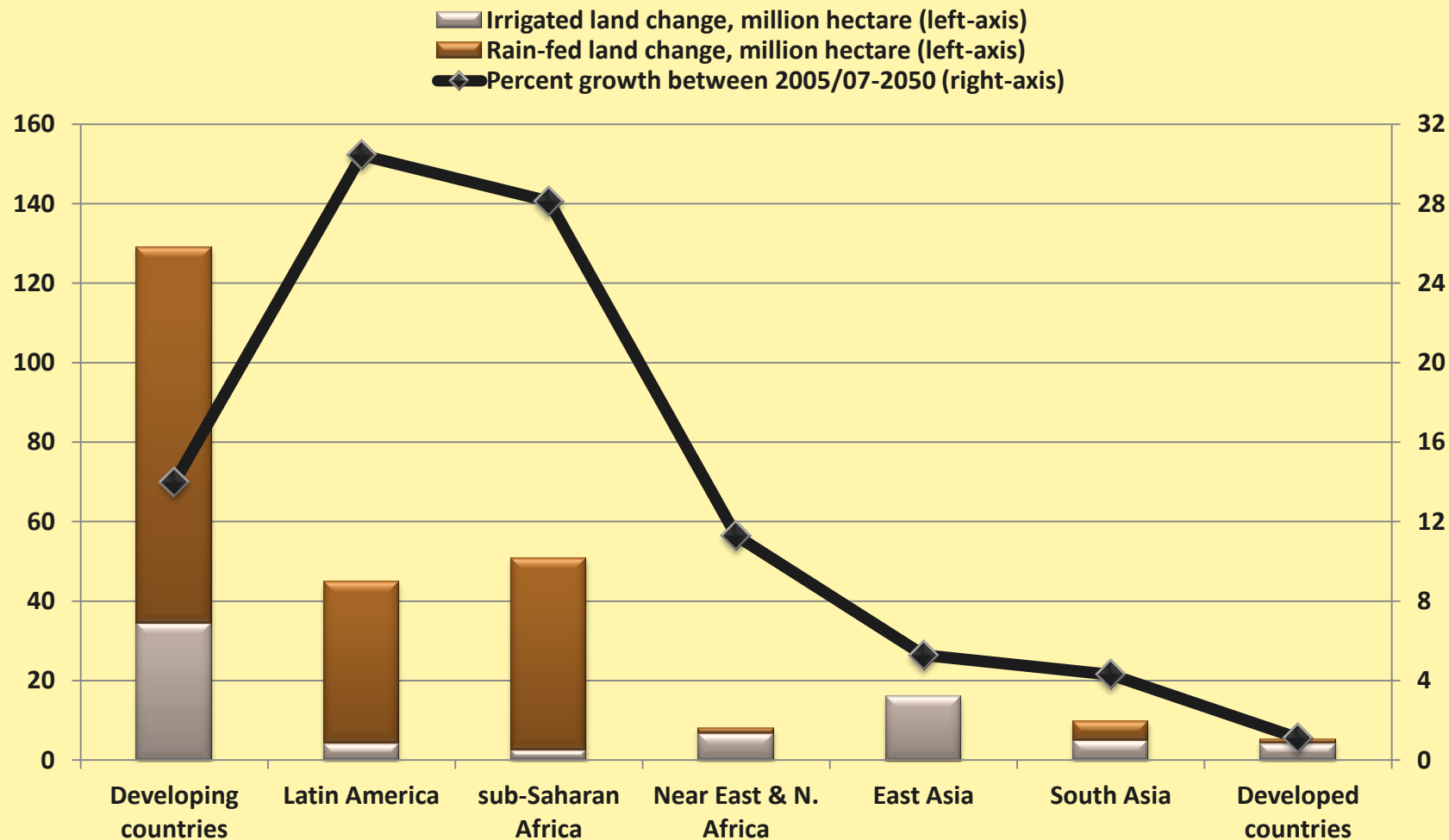


Source: Foley et al (2011), "Solutions for a cultivated planet," Nature, 478, 337-342



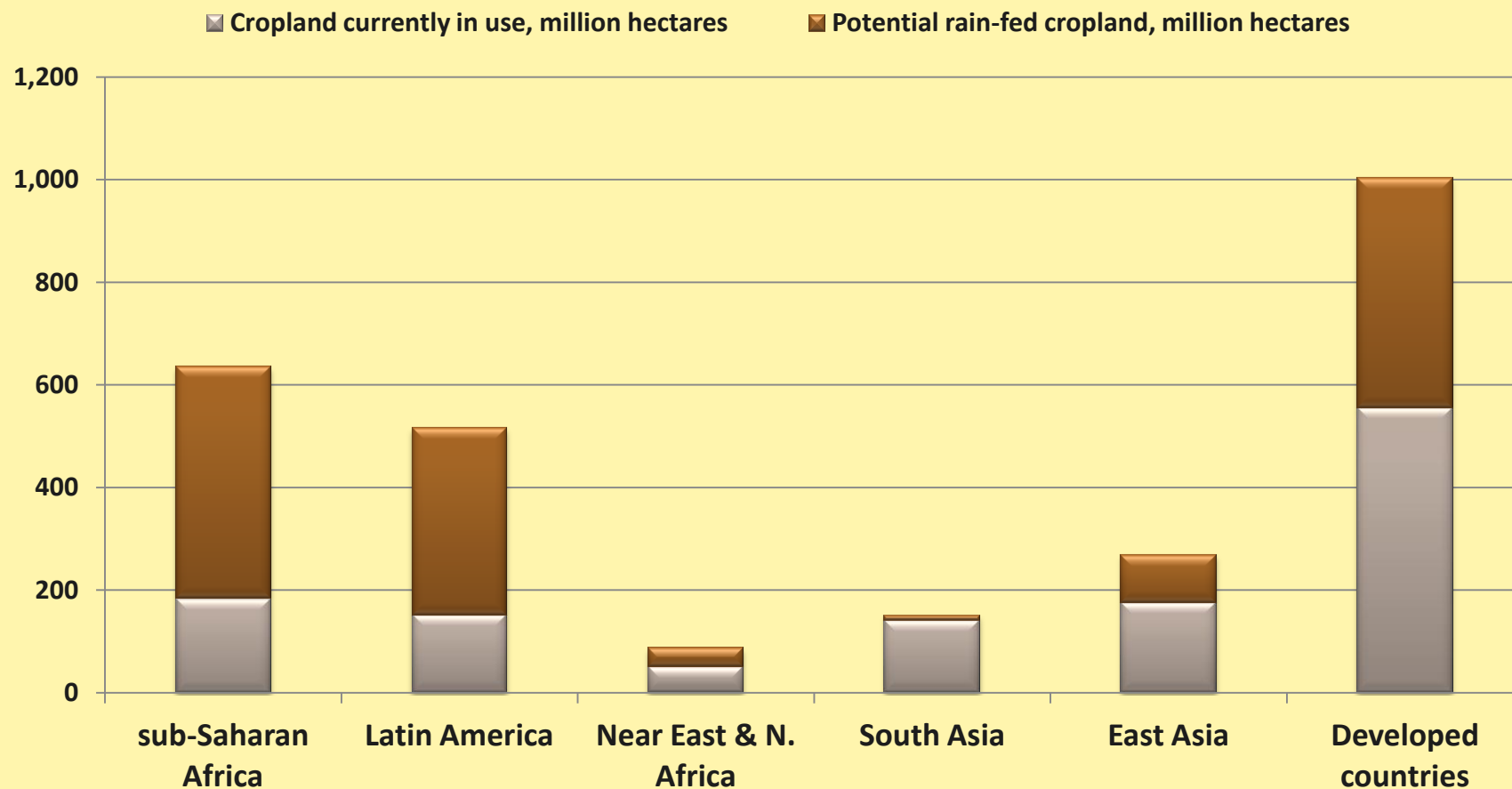
Largest increases in harvested land in Latin America and SSA

Changes in harvested land between 2005/07 and 2050





Land expansion potential, though concentrated in certain regions

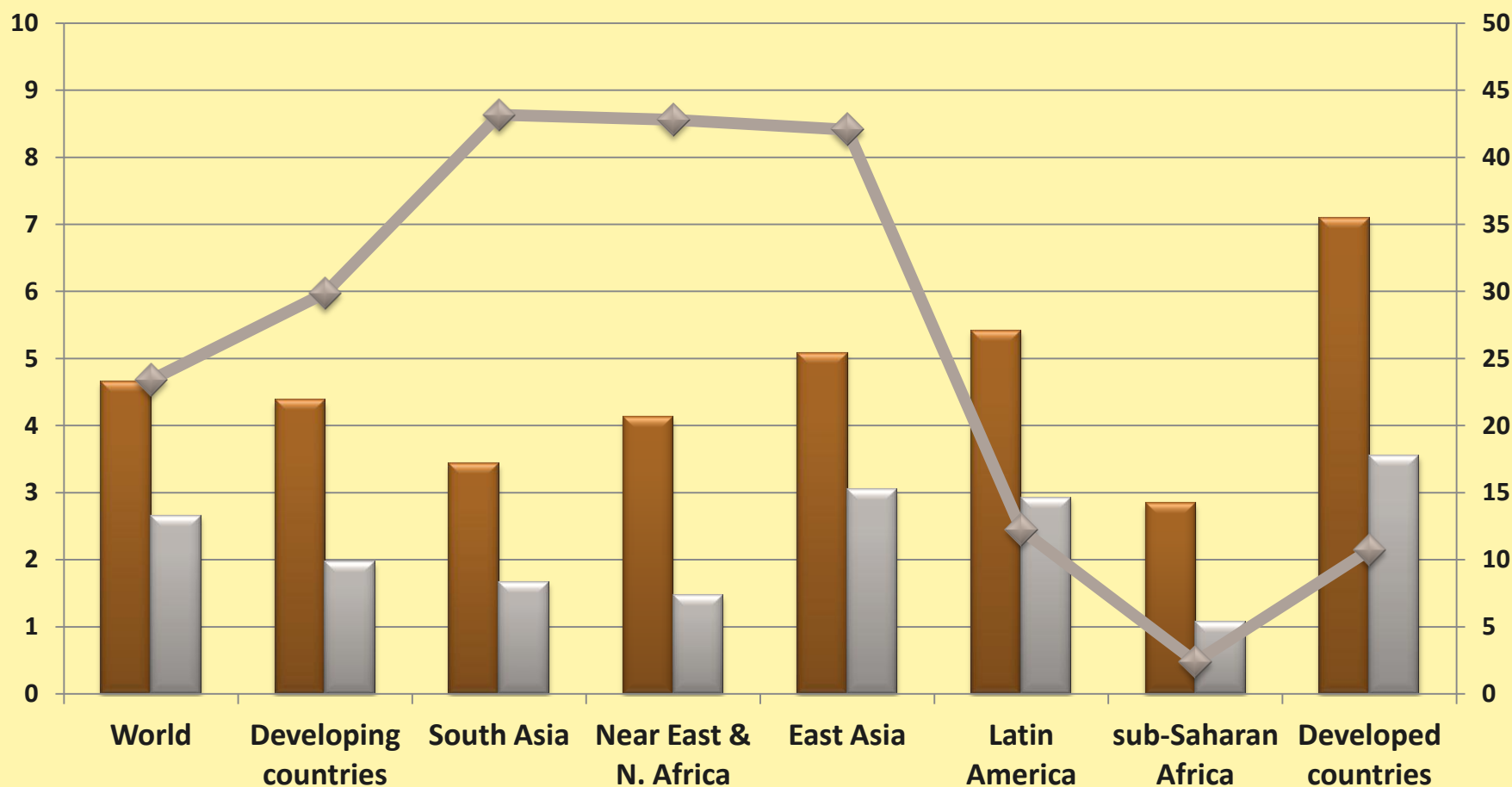


Source: GAEZ-v3.0 in Fischer et al 2011.



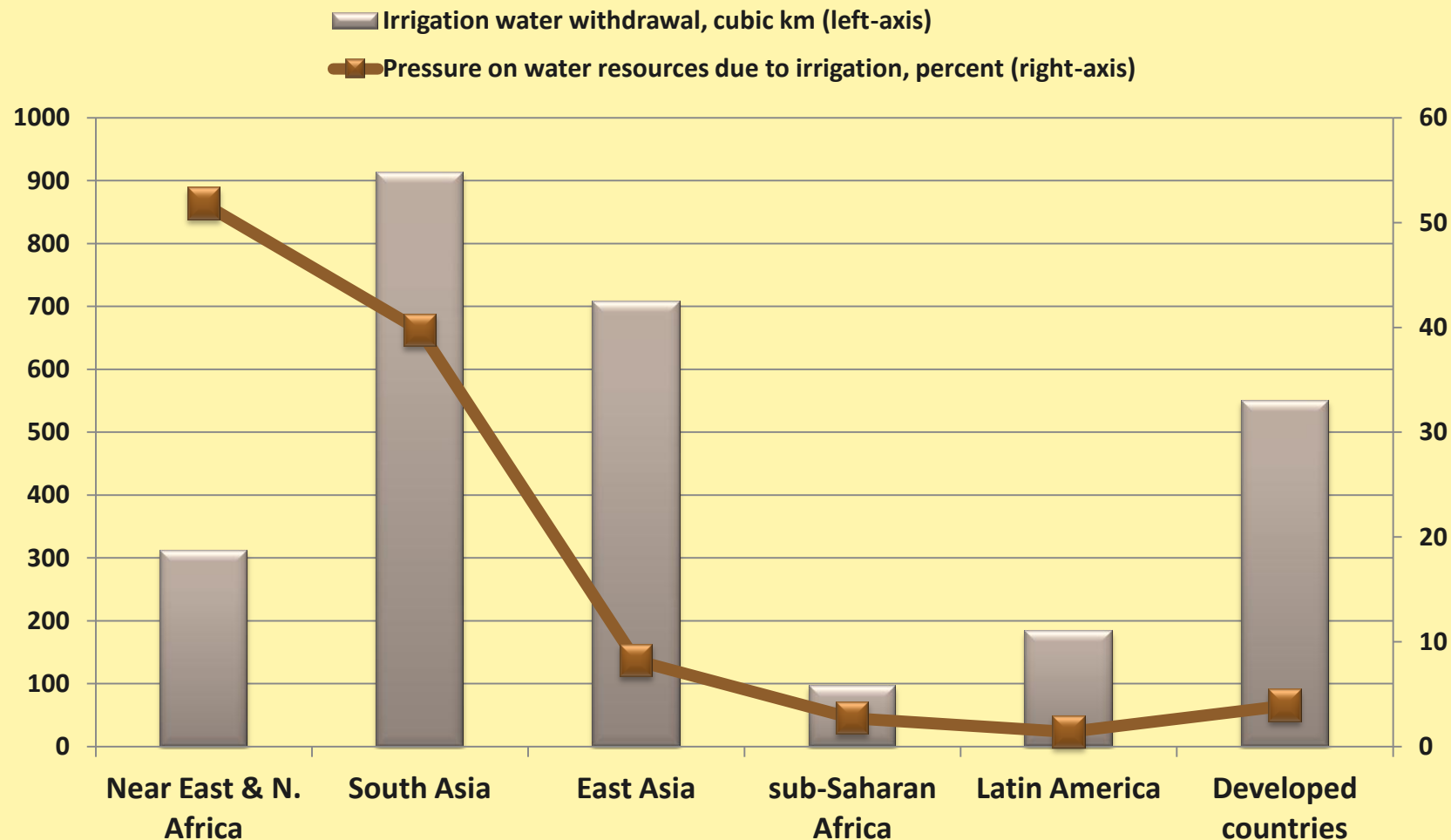
Yields much higher on irrigated land that is very scarce in SSA

■ 2005/07 yield on irrigated land, tons per hectare (left-axis)
■ 2005/07 yield on rain-fed land, tons per hectare (left-axis)
◆ Irrigated land as percent of total harvested land (right-axis)



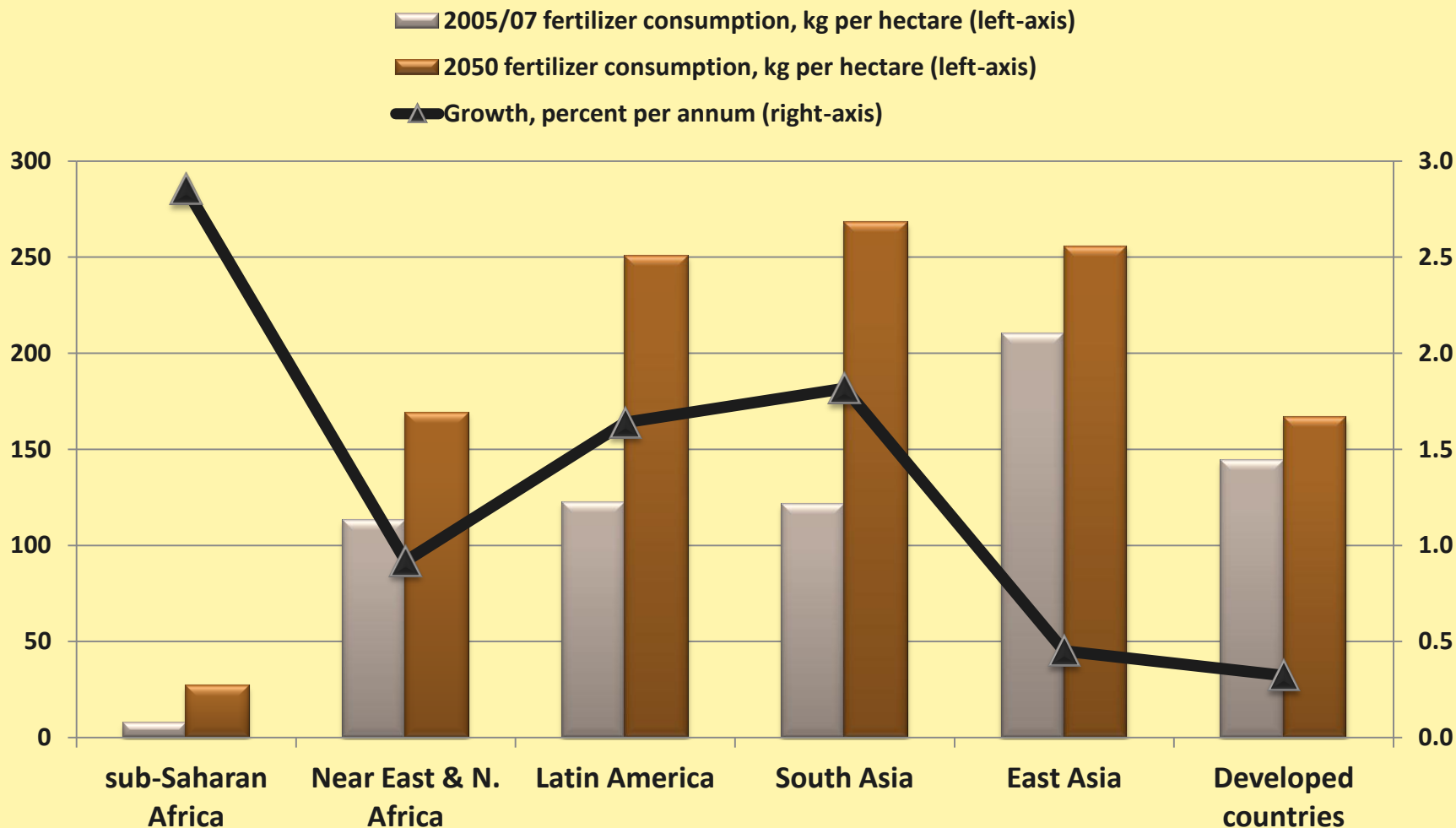


Strong competition for water in Near East/N. Africa and South Asia





High fertilizer use in East Asia, South Asia and Latin America will follow suit





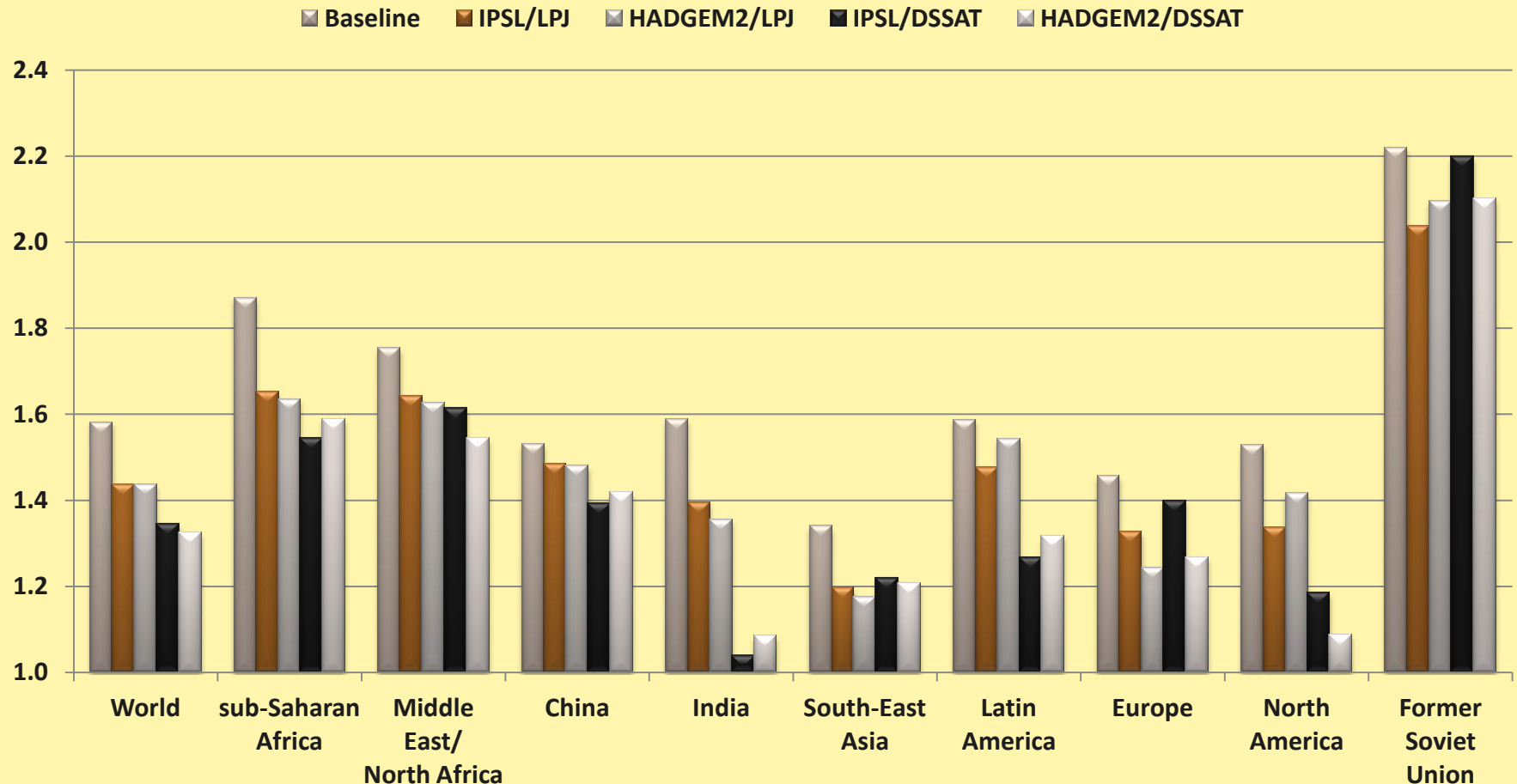
Caveats

- **Large uncertainties**
 - Drivers—population, GDP, technology
 - Behavioral assumptions—diets, waste, etc.
- **Emergence of non-food uses for agriculture**
 - Bio-energy
 - New industrial technologies
- **Climate change**



Potential impacts of climate change are significant, but large range of uncertainty

Potential impacts on crop yields using different climate and crop models (index 2005=1)



Source: Agricultural Modeling Intercomparison and Improvement Project (AgMIP).



Take-away messages

- **Potential to feed 9 billion in 2050 is attainable**
 - **Yield gaps are high**
 - **Diets may change in response to health and environmental concerns**
 - **Population growth may be over-estimated**
 - **Waste and losses could be reduced**



Take-away messages

- **However...**
 - Huge regional differences in demand growth and supply potential
 - Production sustainability is not guaranteed
 - Energy-agricultural nexus is still in infancy, long-term impacts not known for sure
 - Climate change—particularly severe events—may impact agricultural potential everywhere, but especially in developing countries with low capacity to adapt



Take-away messages

- **Priorities—supply side**
 - **Raise productivity in lagging regions, particularly in sub-Saharan Africa**
 - Greater availability of modern inputs
 - Investments in water infrastructure
 - Improve financing
 - **Improve water management, particularly in South Asia and Near East/North Africa**
 - **‘Climate smart’ agriculture**
 - Limit agriculture-based greenhouse gas emissions
 - Build-in resilience to inevitable effects of climate change



Take-away messages

- **Priorities—more broadly**
 - Enhance safety nets to ensure adequate nourishment
 - Improve domestic markets
 - provide better market signals for producers
 - and enables them to take advantage of market opportunities
 - Accelerate development
 - Strengthen the global trading system
 - Need to smooth out and manage higher price volatility
 - Facilitate trade in regions with potentially growing imbalances between supply and demand



Further reading

- Alexandratos, Nikos and Jelle Bruinsma (2012), “World Agriculture Towards 2030/2050: The 2012 Revision,” *ESA Working Paper*, No. 12-03, June, FAO, Rome.
- Conforti, Piero, editor (2011), *Looking Ahead in World Food and Agriculture: Perspectives to 2050*. Conference volume of Expert Meeting on “How to Feed the World In 2050”, 24-26 June 2009, FAO, Rome.
- FAO, *The State of Food Insecurity in the World*, various editions.
- FAO, *The State of Food and Agriculture*, various editions.

www.fao.org/economic/esa