RESEARCH PROGRAM ON Water, Land and Ecosystems

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INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

sustainable solutions for ending hunger and poverty

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The role of science and scenario modeling in setting priorities for SDGs

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Opening Remarks

- SDGs need to reflect the "New Normal":

  - Growing natural resource scarcity and poor environmental outcomes affect poor people most
  - Tighter global agricultural supply and demand has real implications for food security
  - Enhanced environmental sustainability is essential for poverty alleviation and food security
  - SDGs need to move beyond assessing biophysical and social aspects of producing food in silos
  - Tradeoffs among goals need to be acknowledged, examined and measures to minimize these need to be identified
  - More work is needed on the science-policy interface

Sample SDGs

- Universal access to basic sanitation
- Universal access to modern forms of energy
- Universal access to adequate food to lead healthy and productive lives
- Atmospheric GHG concentration stabilization below 450 ppm
- Zero land degradation by XX
- Zero biodiversity losses

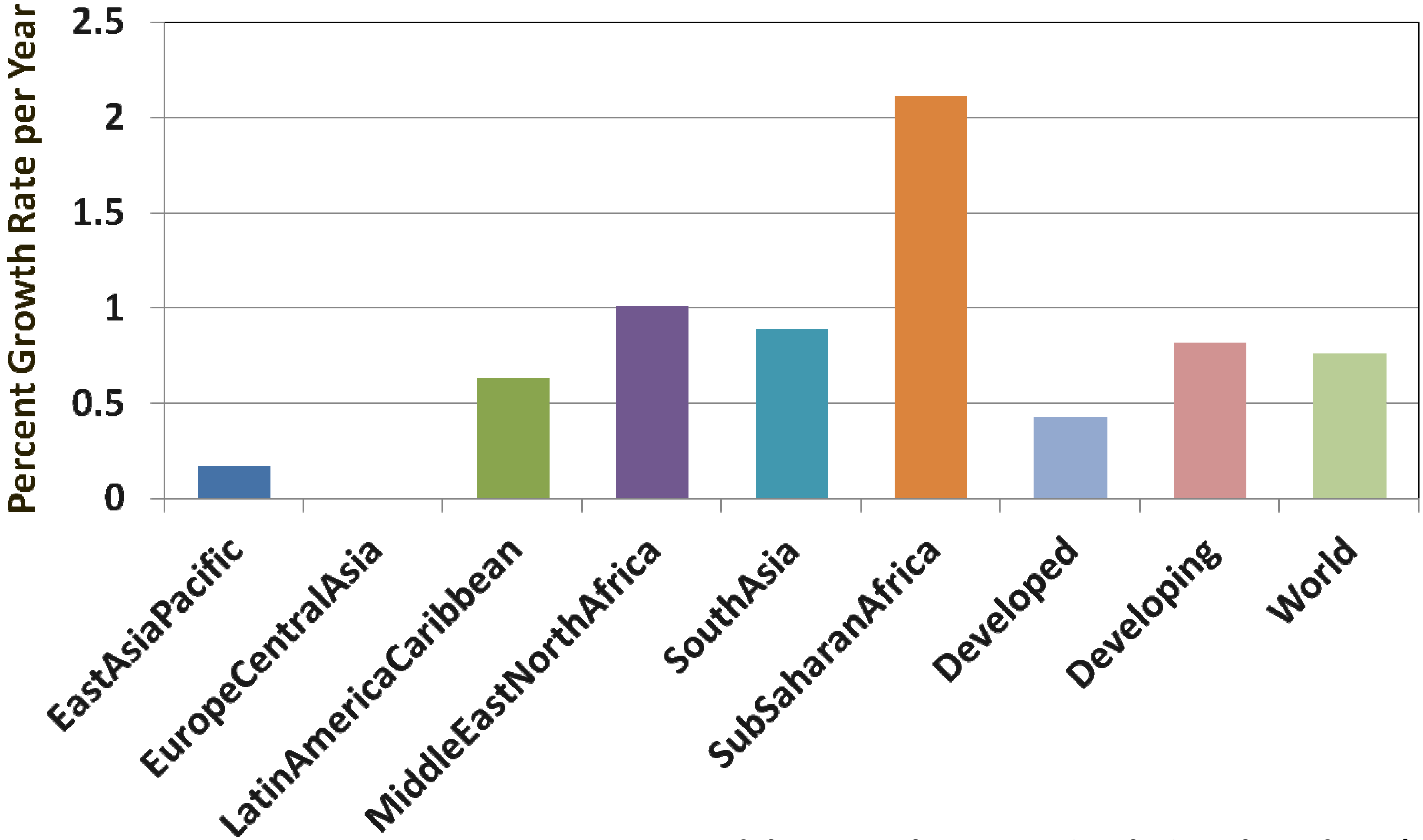
Drivers of Agricultural Growth and Food Security

- DEMAND site
  - Population growth: 9 billion people in 2050
  - Urbanization: 2008 = 50% urban; 2050 = 78% urban
  - Income growth
  - Biofuels and bioenergy
  - GHG mitigation and carbon sequestration
  - Conservation and biodiversity

Drivers of Agricultural Growth and Food Security

- SUPPLY site
  - Water and land scarcity
  - Climate change
  - Investment in agricultural research
  - Science and technology policy
  - Management and governance reform

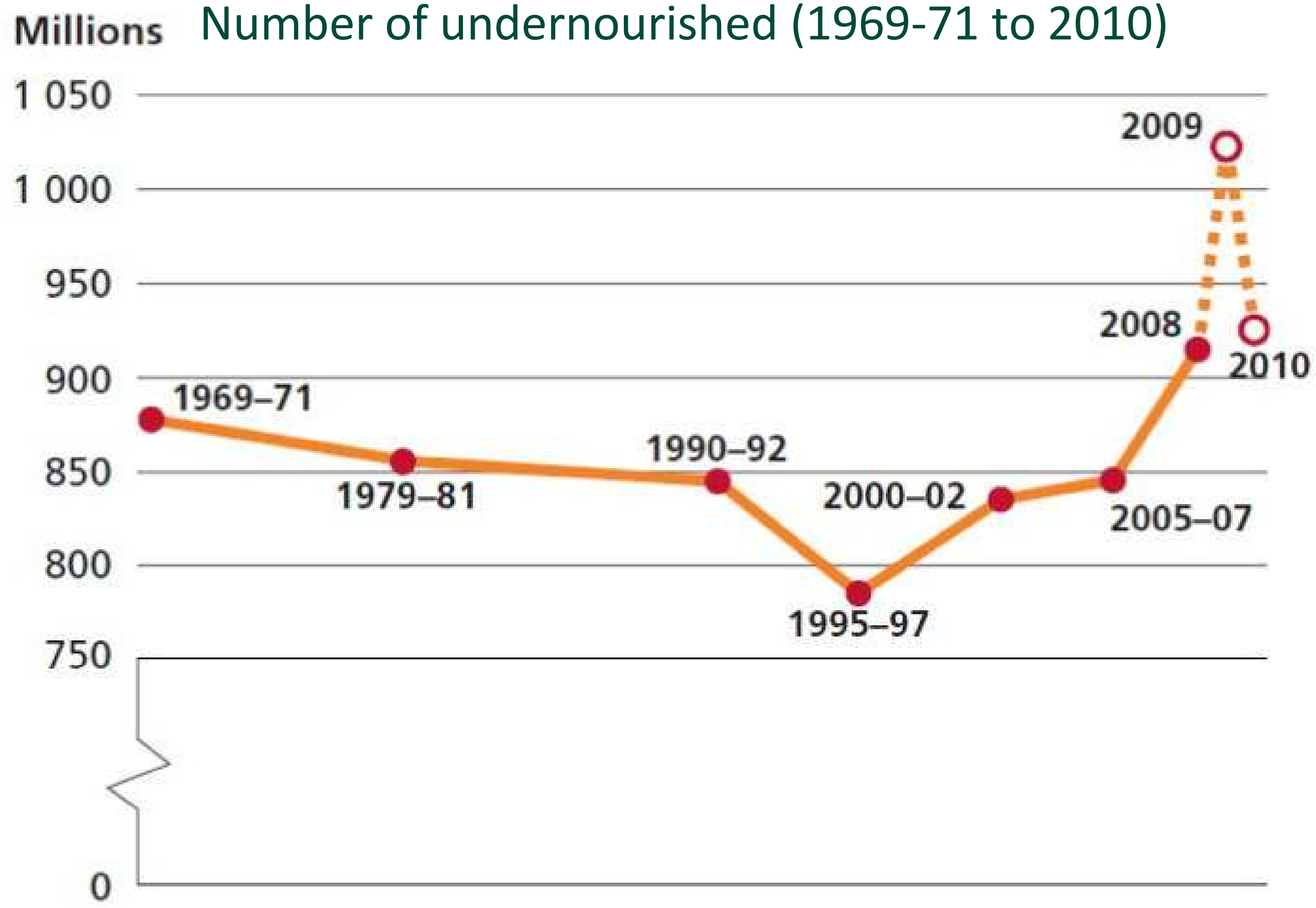
Annual Average Growth in Population between 2010 and 2050 – Baseline Projections



Source: IFPRI IMPACT Model, September 2011 simulations based UN (2011).

Hunger remains unacceptably high

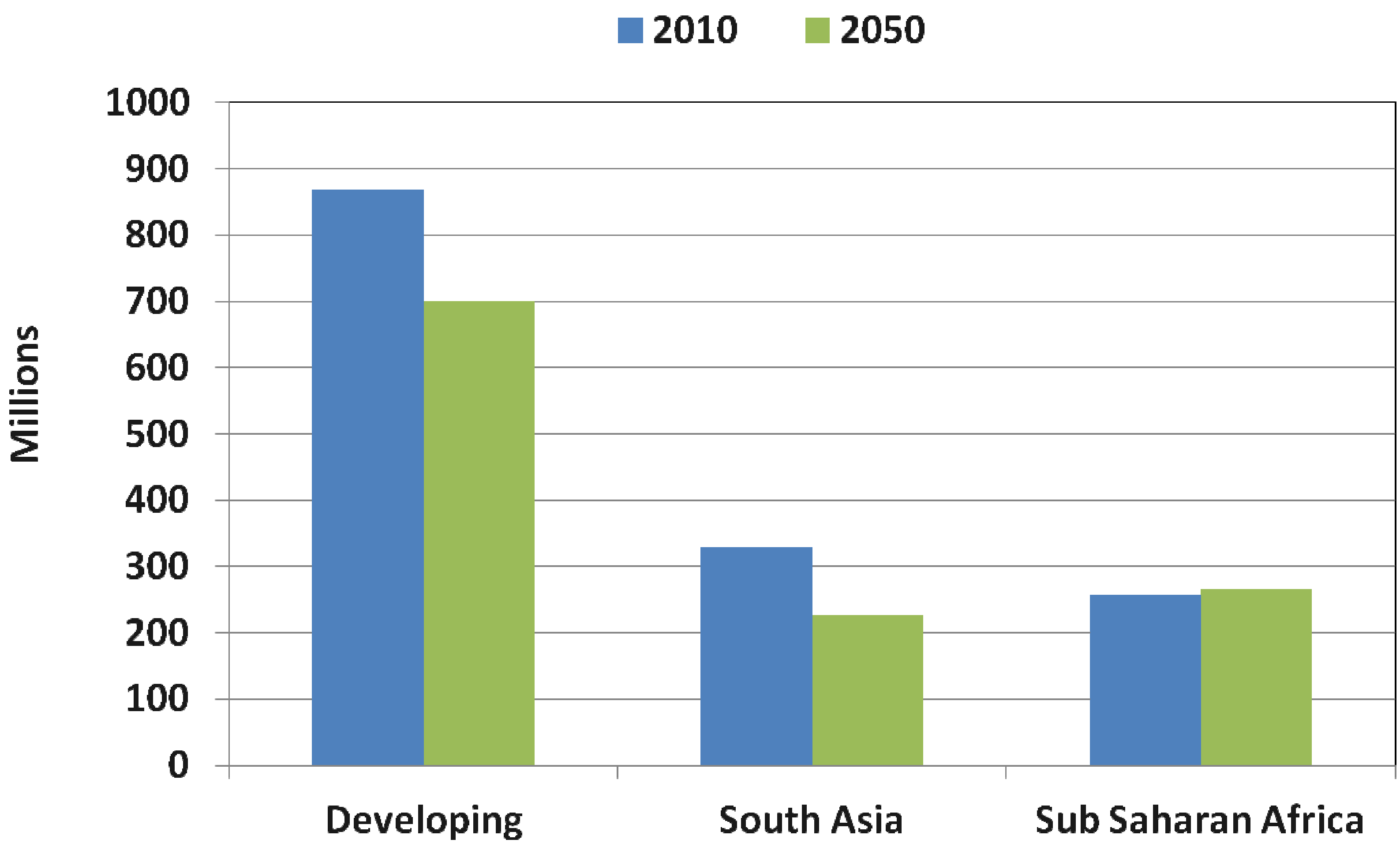
Number of undernourished (1969-71 to 2010)



Note: Figures for 2009 and 2010 are estimated by FAO with input from the United States Department of Agriculture, Economic Research Service.

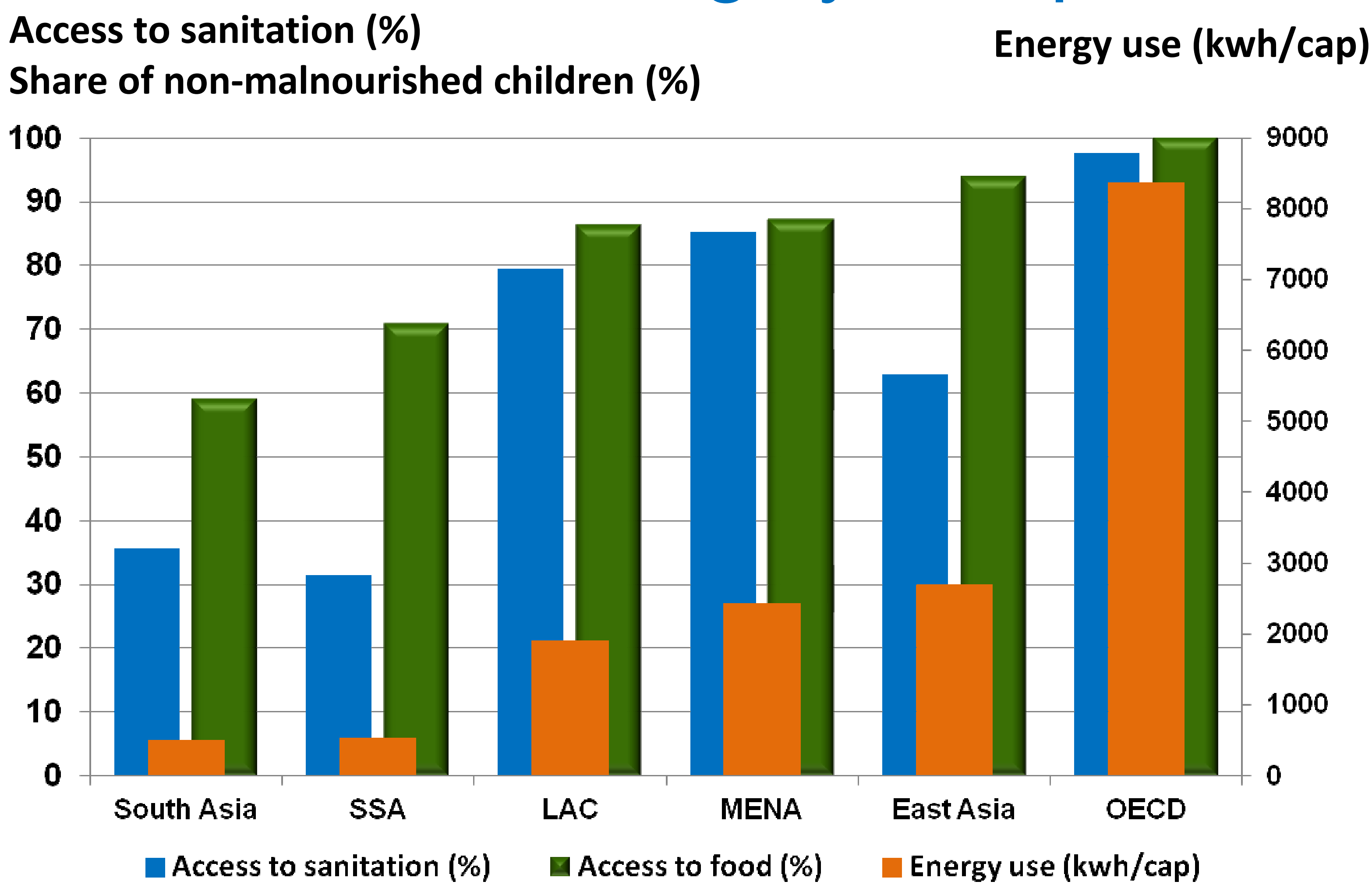
Source: FAO 2010

Population at Risk of Hunger



Source: IFPRI IMPACT Model, September 2011 simulations

Access to water, food and energy remains highly unequal



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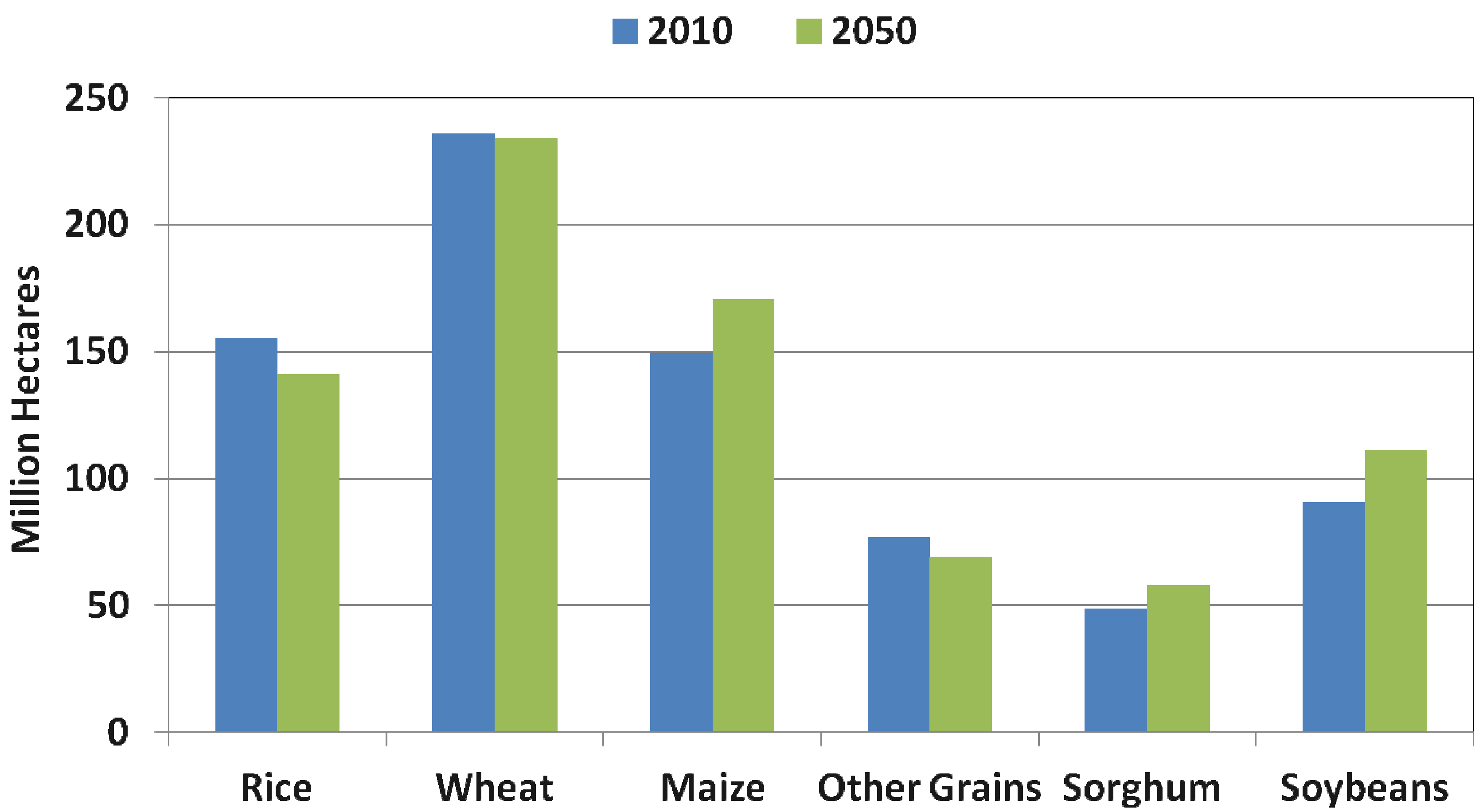
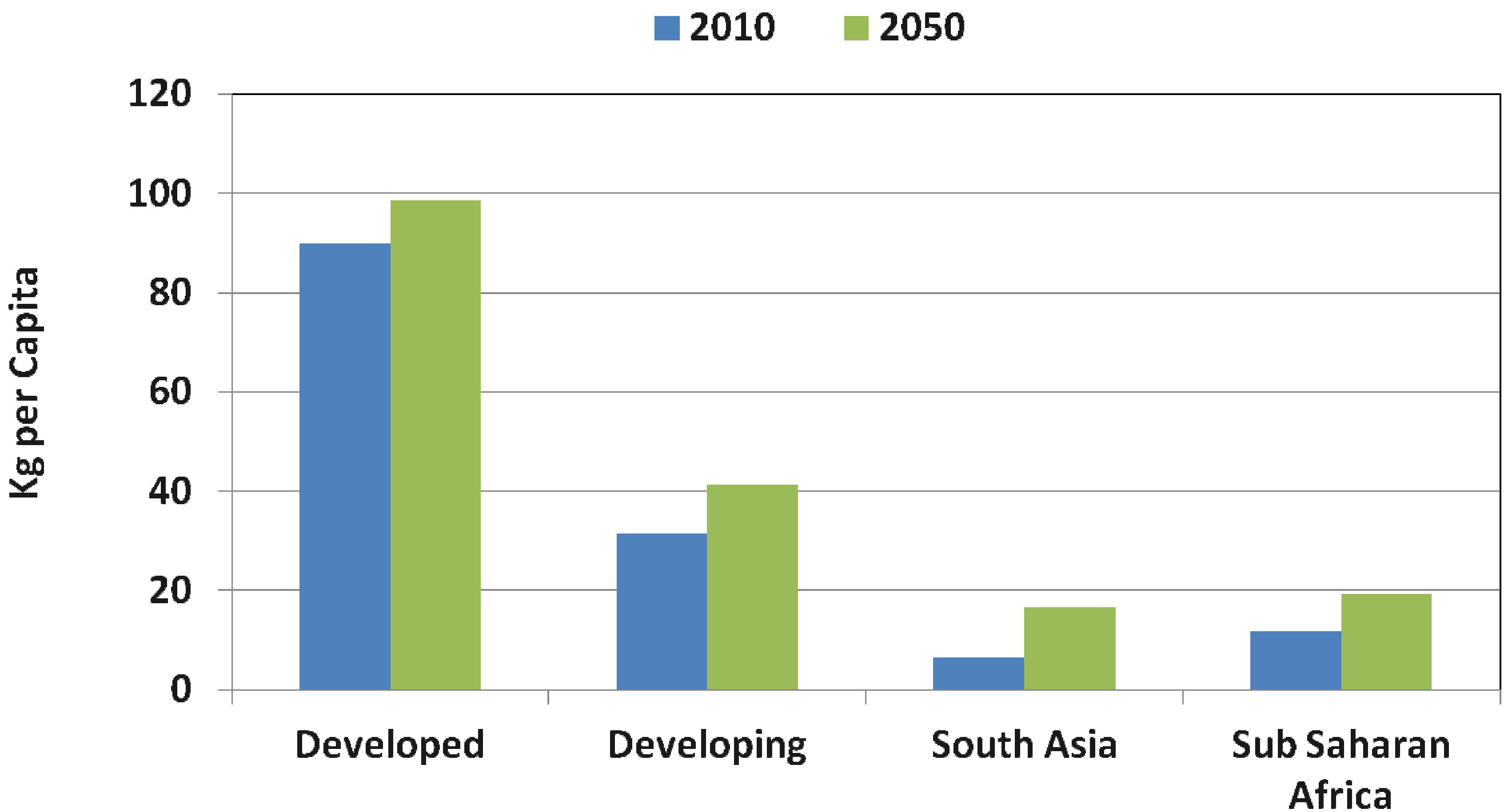
World Crop Area- Baseline Projections



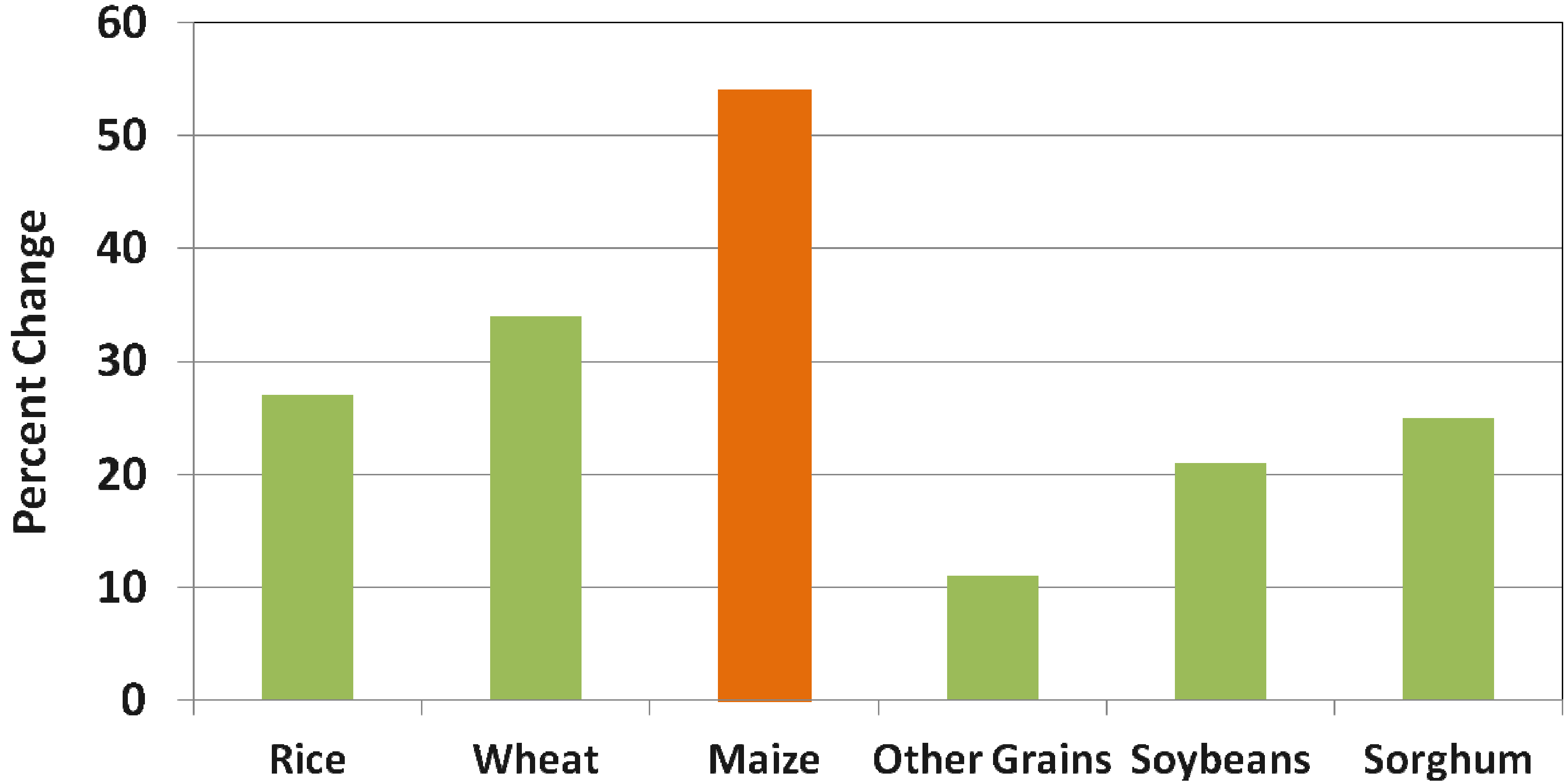
Source: IFPRI IMPACT Model, September 2011 simulations

Per Capita Meat Demand-Baseline Projections



Source: IFPRI IMPACT Model, September 2011 simulations

Percent Change in World Prices of Cereals between 2010 and 2050



Source: IFPRI IMPACT Model, September 2011 simulations

Today, 36% of population, 39% of grain production, and 22% of global GDP are at risk due to water stress

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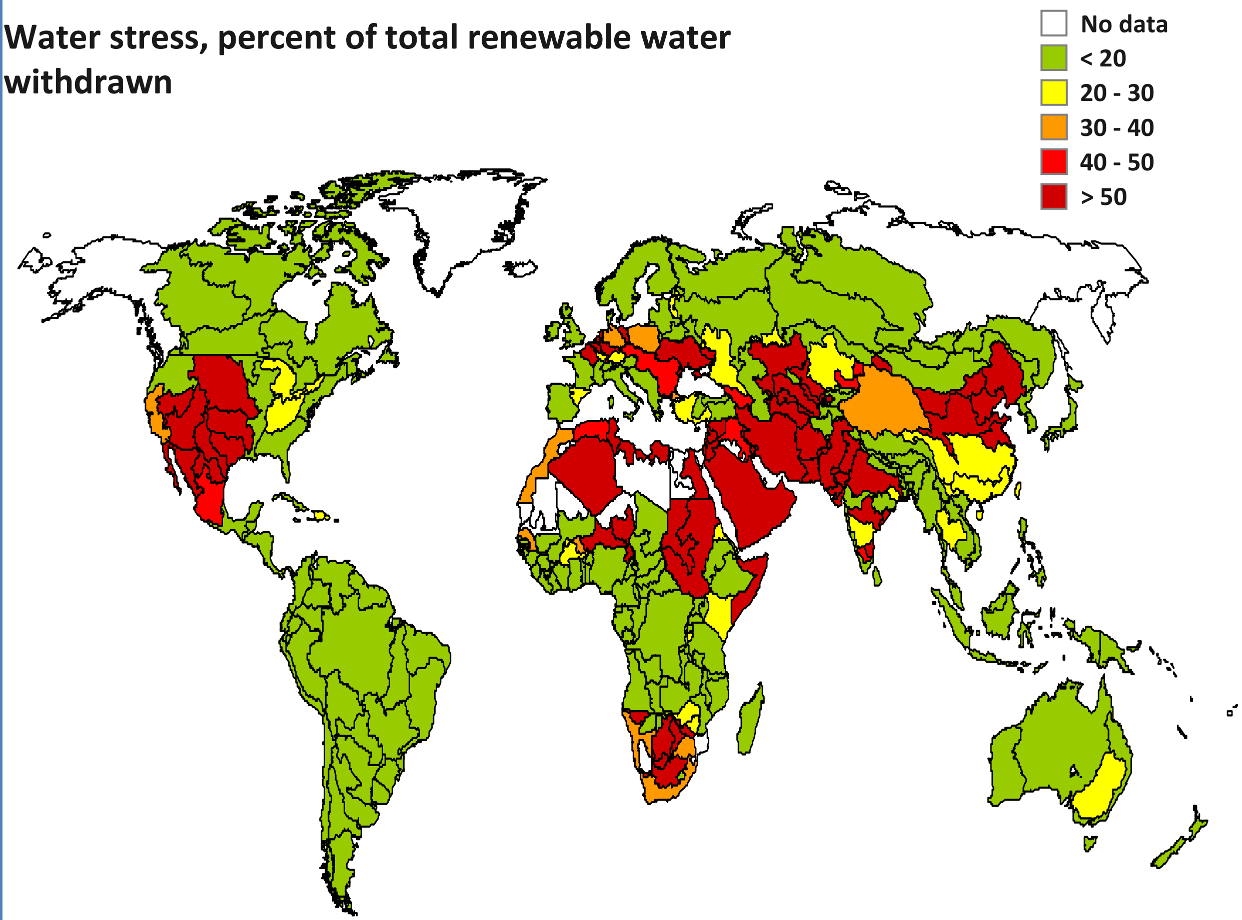
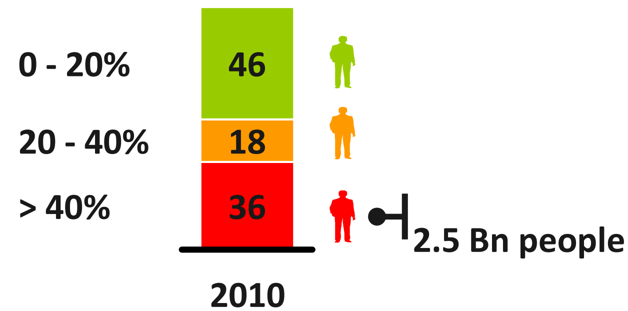
2010

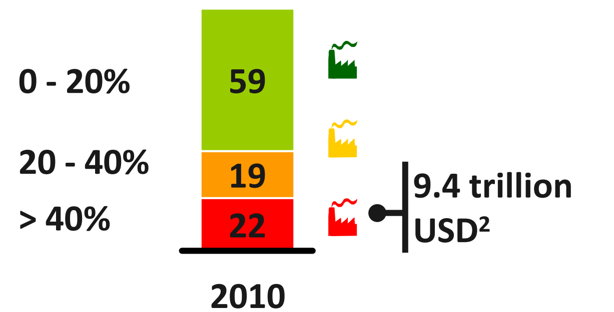
Water stress, percent of total renewable water withdrawn



How many people live in water short areas (%)?



How much GDP is generated in water scarce regions (%)?



Source: Veolia Water & IFPRI, 2011

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By 2050, 52% of the population, 49% of cereal production and 45% of GDP will be at risk due to water stress

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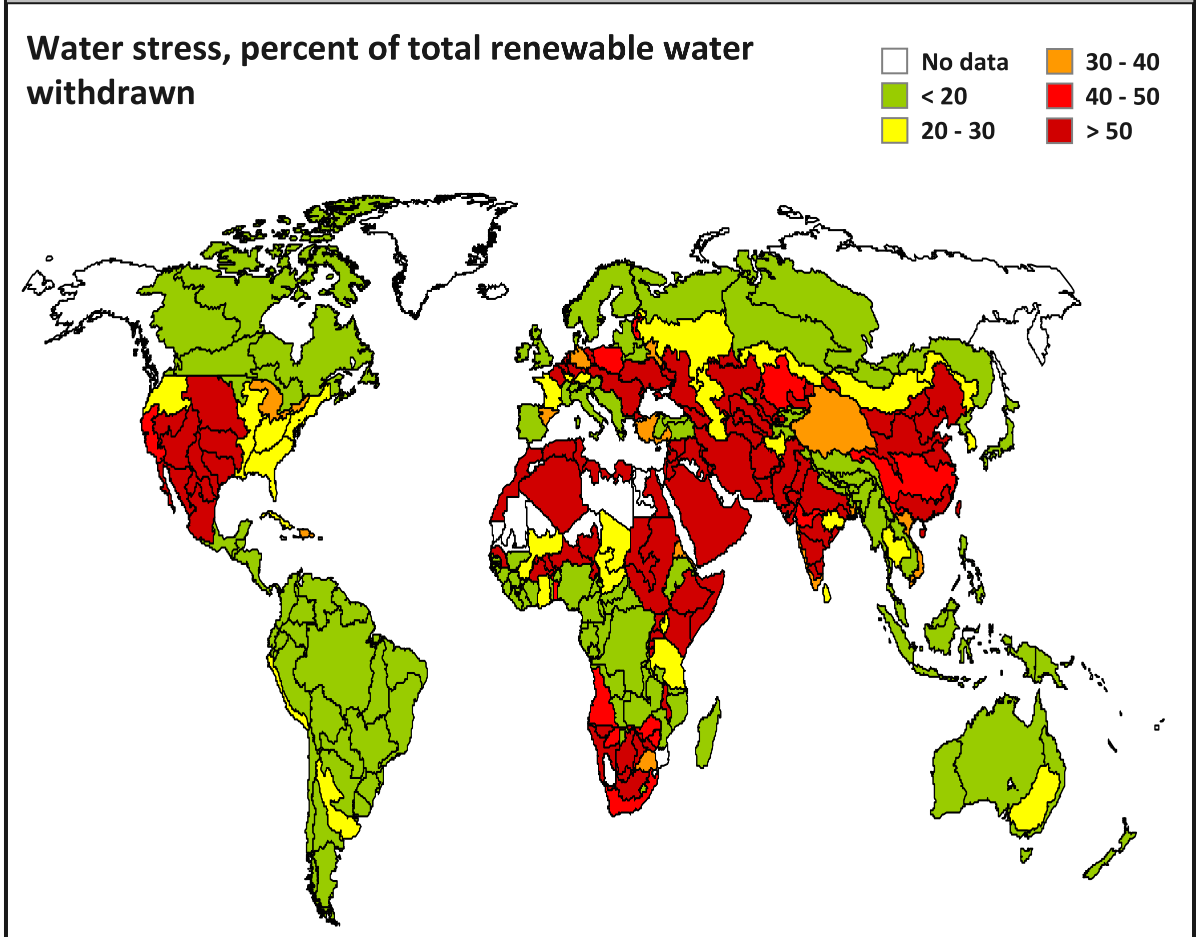
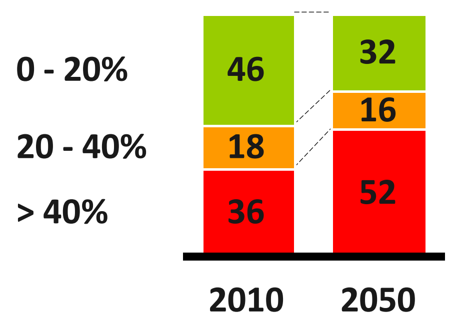
Business as usual, 2050

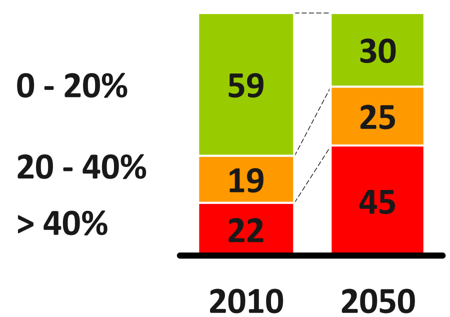


How many people live in water short areas?



- 4.7 Bn people
- Increase by 90% compared to 2010

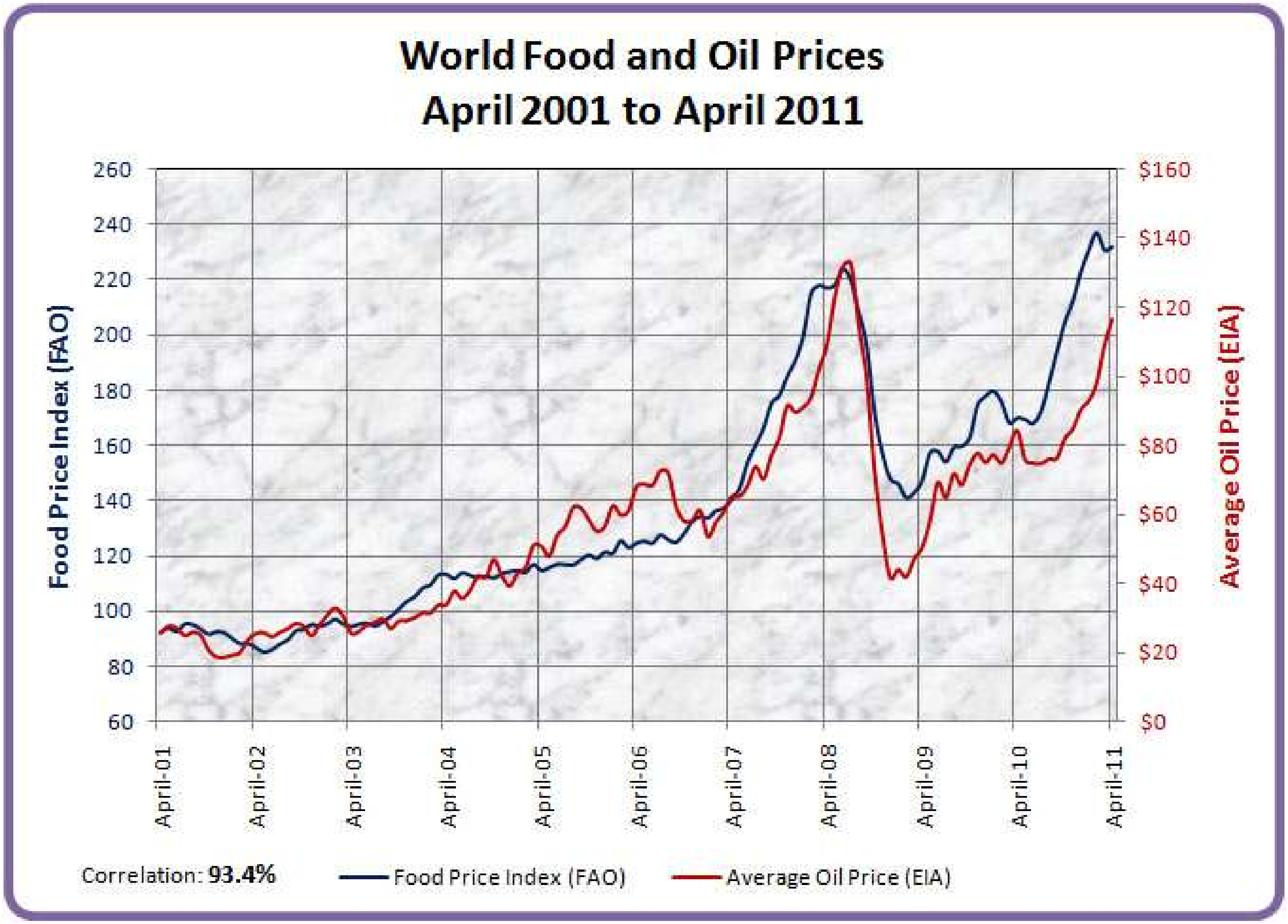
How much GDP is generated in water scarce regions?



- 63 trillion USD
- Increase by 570% compared to 2010

Source: Veolia Water & IFPRI, 2011

Food and oil prices are increasingly linked



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Scenarios Compared to Baseline

- Scenario 1 – Yield Increase
  - Higher crop productivity growth rate resulting in higher crop yields
  - Increase the productivity growth rate for each crop such that the projected crop prices in 2050 in real terms are the same as crop prices in 2010 in real terms
- Scenario 2 – Energy Shock
  - Doubling of oil prices in 2050 compared to baseline
  - Higher fertilizer price (fertilizer price growth rate increased by 75%)

Changes in World Prices of Crops Relative to Baseline, 2050

Commodity/Scenario	Yield Increase	Energy Shock
Rice	-20.2%	9.8%
Wheat	-26.3%	10.1%
Maize	-36.3%	13.4%
Other Grains	-12.0%	6.4%
Soybeans	-19.2%	8.2%
Sorghum	-17.7%	6.5%

Source: IFPRI IMPACT Model, September 2011 simulations

Changes in World Prices Relative to Baseline, 2050

Commodity/Scenario	Yield Increase	Energy Shock
Beef	-4.9%	2.2%
Pork	-5.8%	2.2%
Poultry	-8.8%	2.5%
Soybean Oil	-15.3%	26.3%
Rapeseed Oil	-22.8%	50.5%
Milk	-3.4%	1.1%

Source: IFPRI IMPACT Model, September 2011 simulations

Changes in World Yield of Crops Relative to Baseline, 2050

Commodity/Scenario	Yield Increase	Energy Shock
Rice	11.8%	-4.7%
Wheat	27.8%	-3.7%
Maize	45.6%	-2.5%
Other Grains	5.3%	-2.8%
Soybeans	12.5%	-3.0%
Sorghum	12.0%	-2.6%

Source: IFPRI IMPACT Model, September 2011 simulations

Impact on Population at Risk of Hunger Relative to Baseline, 2050

Commodity/Scenario	Yield Increase	Energy Shock
East Asia and Pacific	-11%	6%
Europe and Central Asia	-4%	2%
Latin America and Caribbean	-19%	17%
Middle East and North Africa	-16%	8%
South Asia	-32%	19%
Sub-Saharan Africa	-32%	15%
Developed	-1%	4%
Developing	-26%	14%
World	-24%	14%

Source: IFPRI IMPACT Model, September 2011 simulations

Issues to keep in mind when modeling SDG scenarios

1. Spatial disaggregation is highly desirable but difficult in global models. The more aggregated the data and regions the more actual constraints and outcomes are masked
2. The less sectors are (correctly) modeled the more actual constraints are masked (f.ex. In agriculture: land, water, energy and labor need to be modeled at a minimum)
3. Most models focus on technological change as a key deal maker or breaker in improving development outcomes; but in reality, policies and politics matter as much or more and can by themselves trigger innovation (f.ex. US biofuels policy)

Issues to keep in mind when modeling SDG scenarios

4. The energy-food nexus has yet to be fully explored for SDG scenario modeling
5. Importance of including "Economics" in the analysis. F.ex. 1 published study found that "eating less meat" would free up 2700 mha of pasture and 100 mha of cropland implementing the change as a straight reduction of resource use. If economics had been included, gains would be much smaller.
6. Climate mitigation modelers continue to see large potential in bioenergy use for mitigation purposes. The direct and indirect impacts on agricultural production and biodiversity are still under-explored [marginal land is generally not used for production for good reasons. There are few places where crop residues are considered waste, etc.]

Issues to keep in mind when modeling SDG scenarios

7. Do models ever get anything right? Some hindcasting, f.ex. food price developments w/ and w/o biofuel policy are plausible
8. Bridges start to be built by some "environmentalists" supporting an environment for the people as the best way forward (rather than the traditional nature for nature's sake philosophy)
9. The post harvest loss story needs to be better assessed, particularly the economics of recovery (in addition to the actual losses) before it is included as an SDG –it might be more effective to factor externalities of natural resource use into the end cost of products
10. The continued call for redistributing food rather than producing more will remain as effective as the call for redistributing money from the rich to the poor

Review of Monitoring Systems for agricultural development

- What you cannot measure you cannot manage
- Do monitoring systems for agriculture cover both ecosystem health and poverty and human well-being aspects? (Generally not)
- Little evidence for impact of monitoring systems on real-world decision making ➔ Define decisions before measurements
- The measurement inversion – most measurement effort in business cases is spent on variables that have the least information value
- Report can be found on DFID website http://www.dfid.gov.uk/r4d/Output/192446/Default.asp

Review of Monitoring Systems for agricultural development

- A clear conceptual framework to demonstrate an understanding of the system under study. In particular theories of change on how the monitoring results would affect behaviours and explicit linkage to specific decisions
- Clear definition of the target inference space (geography, population) and how that is sampled. This is critical for making sound inferences from the monitoring results in terms of their wider applicability.
- Well-defined sample units or strata. It should be clear how units represent a sample of a larger area for which inference is desired.
- Consistent and well-documented measurement protocols, so that there is opportunity for aggregation and meta-analysis of results towards the development of generalizable knowledge and provision of a reliable picture of state and trends.

Review of Monitoring Systems for agricultural development

- Build scale hierarchy explicitly into the sampling design and statistical analysis methods, which is particularly critical for decision-making on sustainable agricultural intensification (f.ex. through multilevel sampling, and use of mixed effects statistical models)
- Determined efforts to integrate biophysical and socio-economic indicators both conceptually and in sampling frames (challenge to link sampling units used in biophysical monitoring (e.g. fixed area sampling or watershed delineations) with socio-economic monitoring (e.g. households, villages)
- Designs that allow attribution of impacts of interventions. Use statistically sound study designs where possible. Disaggregate indicators across different levels of important conditioning variables (e.g. by gender, income group). Monitor variables along the impact pathway to accumulate evidence of intervention impacts.

Review of Monitoring Systems for agricultural development

- Link choice of variables and indicators to objectives, value of additional information, sample units, and measurement methods. Provide guidelines for interpreting indicators for management or policy decisions.
- Represent uncertainty, both conceptually and in communicating results. Make tradeoffs among objectives explicit
- Make data and information generated by research and government institutions accessible and reduce costs associated with access
- Put in place active mechanisms for dissemination of results to target audiences, beyond web-based dissemination.
- Collect relevant data to be able evaluate the impact and cost-effectiveness of monitoring initiatives, to help make a better case for sustaining initiatives.