Global food security and natural resource scarcities: what are sustainable strategies?

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Draft presentation for Winter School of Volkswagen Foundation “Limits to Growth Revisited”, November 2012
870 m people are undernourished

- Africa: 27%
- Latin America: 6%
- Industrial countries: 2%
- Asia: 65%

Source: FAO (2012).
Hunger is a distribution problem

About 1 billion are overnourished worldwide.

Measures to reduce poverty:
• Economic growth
• Education
• Infrastructure
• Social security
• Good governance
• Avoid strong food price increases

Today's Kcal per capita

Recommended Kcal

2800 kcal
Hunger is also a production problem

- **Today:** 2800 kcal
- **Recommended:** 2500 kcal
- **2050:** 2100 kcal
Global developments since 1960

Source: FAO (2012).
Price developments from 1960 to 2000

Price developments since 2000

Source: FAO (2012).
Nutrition effects of price increases

50% maize price increase in Malawi

Source: Ecker und Qaim (2011).
Development of FAO hunger statistics

Source: FAO (2012).
How do future trends for food demand and supply look like?
## Demand projections until 2050

### Population trends

<table>
<thead>
<tr>
<th></th>
<th>Today</th>
<th>2030</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>World population (billion)</td>
<td>7.0</td>
<td>8.3</td>
<td>9.3</td>
</tr>
<tr>
<td>Industrial countries (billion)</td>
<td>1.2</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Developing countries (billion)</td>
<td>5.8</td>
<td>7.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

### Income growth in developing countries:
- Per capita demand for food increases.
- More meat and other animal products are consumed.

### Demand for food and feed is projected to grow by 70% until 2050.
Use of bioenergy

• Biofuels gain in importance
• Demand increases through:
  ✓ Rising crude oil prices
  ✓ Political support (not only in EU and USA)

• Projection until 2020: 15% of global maize and vegetable oil, 30% of cane sugar to be used for biofuels

Until 2050, total demand for agricultural products (food, feed, fiber, and fuel) could easily double.

This would imply an annual demand growth of 1.8%.
Challenges for food supply

“In the next 50 years we will need to produce as much food as has been consumed over our entire human history.”

Megan Clark
CEO
Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia
How can global supply be increased?

Global production

\[ \text{Arable land} \times \text{Yield} \]

- Limited potential still available
- But increasing environmental costs
- Irrigation
- Chemical inputs
- Technical progress
Growth rates in worldwide cereal yields

Source: FAO (2012).
Shortcomings in agricultural research

Growth in worldwide agricultural research investments has been declining since the mid-1990s.

Especially in industrial countries, yield growth is not the top priority in agricultural research anymore.
Yield effects of climate change until 2050

Challenges until 2050

- Climate change
- Resource scarcity
- Demand projection
- Research and technology

Global cereal yield (t/ha)
What type of technologies?

- Technologies have to be sustainable
- Sustainability requires scarce resources to be used as efficiently as possible
- In the public „sustainable agriculture“ is often misunderstood as traditional, low-input production
- Too many entrenched views (organic farming vs. GMOs etc.)
- Sustainable production systems require a smart combination of all areas of science, including new technologies
Beyond increasing supply, what about influencing demand?

For example:
- Meat consumption
- Biofuels

We have done some very simple simulations, analyzing scenario impacts on the number of undernourished.
Mechanisms for simulations

Example: Reduction in meat consumption

1. Grain demand for direct consumption increases
2. Demand for feed decreases
3. Lower prices, lower supply
4. Quantity available for food use increases

Grain market

Price

Quantity

Food

Feed

Food
Results of simulations

Reduction in meat consumption

<table>
<thead>
<tr>
<th></th>
<th>Undernourished (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status Quo</td>
<td>870</td>
</tr>
<tr>
<td>D -50%</td>
<td>866 (-0.5%)</td>
</tr>
<tr>
<td>EU -50%</td>
<td>845 (-3%)</td>
</tr>
<tr>
<td>OECD -50%</td>
<td>805 (-7%)</td>
</tr>
</tbody>
</table>
Nevertheless, production needs to be increased, but where?

Agricultural growth in developing countries is of particular importance, because this is where:

- almost all hungry people live,
- almost all of the population growth takes place,
- the projected negative impacts of climate change are particularly strong.

In addition, around 75% of all hungry people live in rural areas of developing countries.

Agricultural growth in the small farm sector helps to increase poor people’s incomes, thus reducing poverty and inequality.
What suits the small farm sector?

System of Rice Intensification (SRI) in Timor Leste

- New technology for rice
- Agronomic innovation: less water, fewer inputs, more labor
- Requires intensive training and extension
- Up to 50% higher yields in some situations

Source: Noltze, Schwarze, Qaim (2012)
GM cotton (Bt) in India: income effects

Source: Subramanian and Qaim (2010).
Industrial countries have to contribute to global supplies, too

Net exports in cereal trade

- **2010**
- **2050 (projection)**

Million tons

<table>
<thead>
<tr>
<th>Region</th>
<th>2010</th>
<th>2050 (projection)</th>
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</thead>
<tbody>
<tr>
<td>Industrial</td>
<td>150</td>
<td>300</td>
</tr>
<tr>
<td>Africa</td>
<td>-200</td>
<td>-150</td>
</tr>
<tr>
<td>Asia</td>
<td>-100</td>
<td>-50</td>
</tr>
<tr>
<td>Latin America</td>
<td>-20</td>
<td>50</td>
</tr>
</tbody>
</table>
Role of productivity in EU agriculture

- Status Quo: 870
- EU27 Cereal productivity of 1980: 979 (+13%)
Conclusion

1. Hunger is still a very widespread problem, involving both issues of distribution and production.
2. Currently, food supply is growing slower than demand.
3. More sustainable consumption is important.
4. Required production increases are a huge challenge, but possible with more research, technology, and innovation.
5. Ideological barriers have to be overcome.
6. The small farm sector in developing countries needs special attention to reduce hunger and poverty.
7. But also agriculture in rich countries plays an important role. Food security and resource scarcities are global issues.