The Coming Famine

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The human surge

World Population: 1950-2050

Source: U.S. Census Bureau, International Data Base, August 2006 version.
### Food demand

<table>
<thead>
<tr>
<th>Year</th>
<th>Cereals (million tonnes)</th>
<th>Other crops (million tonnes)</th>
<th>Animal products (million tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing</td>
<td>940</td>
<td>1882</td>
<td>2419</td>
</tr>
<tr>
<td>Developed</td>
<td>754</td>
<td>952</td>
<td>961</td>
</tr>
<tr>
<td>World</td>
<td>1694</td>
<td>2834</td>
<td>3380</td>
</tr>
</tbody>
</table>
Key constraints

- Acute shortages of surface water
- Falling groundwater tables
- Shrinking land area / soil loss
- Nutrient losses & rising costs
- Declining agricultural R&D
- Impact of collapsing fisheries
- Biofuels impact
- Climate change impacts
Water scarcity today
Groundwater worries

- China – water tables falling by >3 metres /yr
- India: 26 million wells = 200 cu kms/year, levels falling by 2-3 metres/year
- USA: 70 cu kms/year – levels fallen by 100-200m in Arizona
- Libya – “Great Man-Made River” already falling
- Australia – groundwater levels falling / water is ‘double allocated’.
Soil loss
Nutrient pollution

Chlorophyll off S. Asia

Swan River, Perth
Biofuels impact

[Diagram showing world fuel ethanol production from 1975 to 2010, with data for different countries highlighted by color.]
The demand gap

Source: Goldman Sachs 2007
## Nutrient demand

<table>
<thead>
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</thead>
<tbody>
<tr>
<td></td>
<td>(million nutrient tons)</td>
<td>(percent)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developed countries</td>
<td>24.7</td>
<td>81.3</td>
<td>86.4</td>
<td>4.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Developing countries</td>
<td>2.7</td>
<td>62.3</td>
<td>121.6</td>
<td>10.5</td>
<td>2.2</td>
</tr>
<tr>
<td>World total</td>
<td>27.4</td>
<td>143.6</td>
<td>208.0</td>
<td>5.5</td>
<td>1.2</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>9.5</td>
<td>79.2</td>
<td>115.3</td>
<td>7.1</td>
<td>1.3</td>
</tr>
<tr>
<td>Phosphate</td>
<td>9.7</td>
<td>37.5</td>
<td>56.0</td>
<td>4.5</td>
<td>1.3</td>
</tr>
<tr>
<td>Potash</td>
<td>8.1</td>
<td>26.9</td>
<td>36.7</td>
<td>4.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Sources: FAO, IFPRI
Figure 1  Public agricultural R&D spending trends

- **Asia-Pacific**
- **Latin America and the Caribbean**
- **Sub-Saharan Africa**
- **Developing countries**
- **High-income countries**

**Average annual growth (percent per year)**

- **1976–81**
- **1981–91**
- **1991–2000**

Knowledge drought
A world of drought
“The power of population is so superior to the power of the earth to produce subsistence for man, that premature death must in some shape or other visit the human race....gigantic inevitable famine stalks in the rear, and with one mighty blow levels the population.”
World grain stocks

World total grains, days of supply: 1960/01 - 2007/08

Diagram showing the days of supply for world total grains from 1960/01 to 2007/08.
China’s population

Present ->

Present level: approximately 1.4 billion
Sustainable level: around 800-1000 million

Timeline:
- Han Dynasty: 200 BC - 200 AD
- Qin Dynasty: 221 - 207 BC
- Tang Dynasty: 618 - 907 AD
- Song Dynasty: 960 - 1279 AD
- Yuan Dynasty: 1271 - 1368 AD
- Ming Dynasty: 1368 - 1644 AD
- Qing Dynasty: 1644 - 1912 AD

Data sources:
- Mi Hong, 1992
- Durand, 1960
- Hu Huangyong, 1984
- UN98 medium variant
- UN98 low variant
- UN98 high variant
A wealth of life

- There are more organisms in a gram of soil than there are human beings on Earth:
  - Bacteria $10^8$/g
  - Actinomycetes $10^5$/g
  - Fungi $10^5$/g
  - Microalgae $10^3$/g
  - Protozoa $10^3$/g
  - Nematodes $10^2$/g
  - Invertebrates $10^3$/g
Soil opportunities

- unlocking inaccessible nutrients and micronutrients
- the protection and nurture of plant roots
- landscape renewal
- control of pests and diseases
- stimulation of plant growth
- thrifty use of scarce moisture
- amelioration of hostile growing conditions
- physical and biological modification of soils
- use of soils as a carbon bank
- novel foods.
“When the Cold War ended, we expected an era of peace… what we got was a decade of war.”

- Jimmy Carter in the International Herald Tribune commenting on the links between agriculture and armed conflict.
Third World War?
Refugees: rising tide
Drought into opportunity
Solutions

• Massively increase ag R&D: soils focus
• Spread new ag knowhow more quickly
• Plan to cut human numbers
• Recycle all nutrients back into agriculture
• Develop ‘green food’ and ‘green cities’
• Encourage low protein, low-input diets
• Phase out wild harvests; expand gene banks
Australia’s destiny…

• Be the world’s ‘drought experts’
• Be leaders in biological, low-input farming
• Educate future ‘knowledge farmers’
• Share our knowledge generously
• Establish a farm knowledge export sector
• Recognise ag R&D as “defence spending”
• Lead the world in discovering ways to save humanity from outrunning its resources.
Swift’s dictum

"And he gave it for his opinion that whoever could make two ears of corn or two blades of grass to grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country than the whole race of politicians put together."

(Gulliver’s Travels 1726)