Everybody Eats: The Sustainability and Future of Our Global Food System

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Today’s Agenda

• Current Global Food Situation
• Challenges and Issues
• Solutions
• Final Thoughts
Our Broken Food System.....

FAO estimation in consultation with the USDA

Millions of Undernourished People (Globally)
Riots and Protests
Egypt (April, June 2008)

Mexico (2008)

Tunisia (2008, 2011)

Haiti (April 2008)

Photo Sources: AP, Mahesh Kumar A, Fethi Belaid/AFP/Getty Images, www.standeyo.com
By Ariana Cubillos, AP
Global Food Prices

Price of wheat, maize and rice between 1999 and 2011

FAO, 2011
Our Broken Food System.....

80% less than $1.00 per day
20% more than $1.00 per day

World Bank Developer Indicators, 2008
Food as a percentage of total household consumption:

- Vietnam: 50.7%
- China: 39.8%
- India: 49.5%
- Ukraine: 61.0%
- Philippines: 45.6%
- Kenya: 45.8%
- Sudan: 52.9%
- Nigeria: 73.0%

Photo Credits: Reuters, AP, Nomura, AsiaNews.it, Guardian.co.uk, dailymail.co.uk

Nomura, 2011
Ecuador: The Ayme family of Tingo
Food expenditure for one week: $31.55

Menzel & D’Aluisio, 2008
United States: The Revis family of North Carolina
Food expenditure for one week: $341.98

Menzel & D’Aluisio, 2008
The Challenges.....
“Industrial” Agriculture

Fossil Fuel Resources → Machines → Fertilization

Plant Nutrients & Amendments → Machines → Seeding

Seed → Machines → Irrigation

Water → Machines → Pest Control

Agricultural Chemicals → Machines → Harvest & Storage

Solar Energy Precipitation Carbon Dioxide

Purchased Inputs:
- Fossil Fuel Resources
- Plant Nutrients & Amendments
- Water
- Agricultural Chemicals

Farm Production:
- Harvest & Storage
Food Production & Fertilizer Consumption

1961 - 2002

$R^2 = 0.86$

FAO, 2011
Food Production & Resources (1961 – 2002)

- **Fertilizer Consumption (Mt yr⁻¹)**
  - 20
  - 40
  - 60
  - 80
  - 100
  - 120
  - 140
  - 160

- **Food Production (billion tonnes)**
  - 1.5
  - 2.0
  - 2.5
  - 3.0
  - 3.5
  - 4.0
  - 4.5
  - 5.0

- **Agricultural Land Area (billion ha)**
  - 4.4
  - 4.5
  - 4.6
  - 4.7
  - 4.8
  - 4.9
  - 5.0

- **Agricultural Machinery (millions)**
  - 15
  - 20
  - 25
  - 30

- **Land Area Equipped for Irrigation (million ha)**
  - 150
  - 200
  - 250
  - 300

- **Food Production (billion tonnes) vs. Land Area Equipped for Irrigation (million ha)**
  - R² = 0.86

- **Food Production (billion tonnes) vs. Agricultural Land Area (billion ha)**
  - R² = 0.96

- **Food Production (billion tonnes) vs. Agricultural Machinery (millions)**
  - R² = 0.99

- **Food Production (billion tonnes) vs. Land Area Equipped for Irrigation (million ha)**
  - R² = 0.93

FAO, 2011
“Industrial” Agriculture

Fossil Fuel Resources → Machines → Fertilization → Seeding → Tillage → Irrigation → Pest Control → Farm Production → Harvest & Storage

- Solar Energy
- Precipitation
- Carbon Dioxide

Purchased Inputs:
- Plant Nutrients & Amendments
- Seed
- Water
- Agricultural Chemicals

Farm Production
Global Food & Oil Prices

FAO, 2011
Human Population

Year
1750 1800 1850 1900 1950 2000 2050
Global human population (billions)
0 2 4 6 8 10

1 billion
1.6 billion
2.5 billion
6.0 billion
6.5 billion
9.2 billion

Predicted

UN Population Division, 2009

2.5 people per second (80 million per year)
Food Production & Consumption

Yield and Demand Indexed to 1965

- Global Demand (Crop Product Consumption)
- Global Crop Yield


Norman Borlaug (1914 – 2009)

modified from Doyle & Zavislak, 2008
Goldman Sachs, 2007
Agricultural Land Area & Available Land

- **Sub-Saharan Africa**: 1.1 billion hectares (17%)
- **Central/South America**: 1.0 billion hectares (14%)
- **Europe**: 0.38 billion hectares (46%)
- **India**: 0.21 billion hectares (77%)
- **United States**: 0.36 billion hectares (49%)
- **China**: 0.20 billion hectares (71%)

Planted Crops

Total Arable, Rain-Irrigated Land

*Source: World Soil Resources Report, 2000*
“Land Grabbing”

LEGEND
- National boundary

[Selling Land]  [Purchasing Land]

von Braun & Meinzen-Dick, 2009
Soil Degradation

“The history of every nation, is eventually written in the way in which it cares for its soil”

-- Franklin D. Roosevelt

Photos by Jim Richardson, National Geographic
<table>
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<tr>
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<th>Mixed Land Use</th>
<th>Urban Areas</th>
<th>Agricultural Areas</th>
</tr>
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<tbody>
<tr>
<td>Ground Water</td>
<td>33%</td>
<td>49%</td>
<td>59%</td>
</tr>
<tr>
<td>Streams</td>
<td>100%</td>
<td>99%</td>
<td>92%</td>
</tr>
<tr>
<td>Fish</td>
<td>96%</td>
<td>100%</td>
<td>85%</td>
</tr>
</tbody>
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Global Climate Change

Vegetation anomaly (NDVI)

USDA Foreign Agricultural Service & NASA, 2005
Global Climate Change

Australian Production (million metric tons)

Wine Grapes

Rice

modified from NY Times, April 17, 2008
How do we move forward?

Are we approaching (or in need of) another food revolution?
Conventional vs Organic

Genetically Modified Food

http://www.american.com

http://www.macalester.edu
Agriculture

Fossil Fuel Resources

Plant Nutrients & Amendments

Seed

Purchased Inputs

Fertilization

Machines

Seedling

Tillage

Irrigation

Pest Control

Farm Production

Harvest & Storage

Solar Energy

Precipitation

Carbon Dioxide

Fertilization

Seeding

Irrigation

Pest Control

Tillage

Seeding

Irrigation

Pest Control

Tillage

Seeding
“Pull” Plants:
- Napier grass (*Pennisetum purpureum*)
- Sudan grass (*Sorghum vulgare sundanense*)

“Push” Plants:
- Molasses grass (*Melinis minutiflora*)
- Silver leaf (*Desmodium uncinatum*)

Dr. Zeyaur Khan, Coordinator of the Push-Pull Programme, http://www.push-pull.net
Push – Pull Pest Management: Kenya

46,054 farmers

Dr Hans Herren, Director-General of ICIPE
Prof John Pickett, IACR, Rothamsted
http://www.push-pull.net
System of Rice Intensification (SRI)

Madagascar

- Planting of seedlings at 8 – 12 days (instead of 30 – 50 days), 25 cm apart

- Keeping soil moist (but well-drained and aerated)

- Intercropping & mechanical weeding

- Utilizing compost and natural fertilizers

Pantanali (1996)
System of Rice Intensification (SRI) Madagascar

- Used in over 40 countries
- 20,000 farmers in Madagascar have adopted
- 90% reduction in seed requirements
- 50% water savings
- 50 – 100% increase in yield
  - China 9 – 10.5 t/ha (national avg = 6 t/ha)

Pantanali (1996), http://sri.ciifad.cornell.edu
Terra Preta Soil Improvement: Amazon

Photograph by Eduardo Neves

Julie Major & Bruno Glaser
Sustainable “Urban” Agriculture

http://greensgrow.org

http://riotofreasons.blogspot.com
Urban Agroecology – Growing Power

http://www.growingpower.org
Urban Vertical Agroecology
Urban Vertical Agroecology

Growing Farmers

Elma C. Lomax Incubator Farm (Cabarrus County)

Photos by John D. Simmons
Food Sovereignty

Thank You!!

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