Addressing the Global Food Challenge

How to feed more people and maintain the planet

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WWF-US
“You can’t wake a person who’s pretending to sleep”

Oromo proverb
Food production is the biggest threat to the planet.
70% of biodiversity loss

70% of freshwater use

25% of GHG emissions

85% of marine stocks fully exploited

Most chemical use

50% of topsoil loss
Humans – 30.45%
Pets and livestock – 66.66%
Wild animals – 2.89%

= 1,000,000 tons

Data: From Vaclav Smil’s *The Earth’s Biosphere: Evolution, Dynamics, and Change*, plus a few other sources
Countries where parks have been downgraded or taken off the books entirely (1990-2013)

Source: WWF PADDtracker.org
Global food

40 years = 8,000 years
x 1 = 7

x 2 = 18
# The China phenomenon

<table>
<thead>
<tr>
<th>Country</th>
<th>Start Period</th>
<th>Population at start of growth period</th>
<th>Years to double GDP per capita&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Britain (1700-1855)</td>
<td>9M</td>
<td>155</td>
<td></td>
</tr>
<tr>
<td>US (1820-1873)</td>
<td>10M</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td><strong>China (1983-1995)</strong></td>
<td><strong>1,023M</strong></td>
<td><strong>12</strong></td>
<td></td>
</tr>
<tr>
<td>India (1989-2006)</td>
<td>822M</td>
<td>17</td>
<td></td>
</tr>
</tbody>
</table>

China doubling of GDP was **12x** the speed of Britain during the Industrial Revolution at **100x** the scale.

400 million lifted out of poverty.

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<sup>1</sup> Time to increase GDP per capita (in PPP terms) from 1,300 to 2,600 USD  
Source: Angus Maddison, University of Groningen
Food prices & food riots, 2004-13

Current food realities

- 7.4 B food experts
- Social media trumps science
- Extremes dominate discussions
- Traceability *and* transparency
- Distrust – trade, globalization, experts
trade is key for food security
Food as a % of U.S. disposable income

Food is cheap, but 800 million can’t afford it.
Half of farm families can’t feed themselves.
Freeze
the footprint of food
We must produce more with less
Productivity & efficiency and waste & consumption
The issue isn’t *what* to think, it’s *how* to think.
On a finite planet, should consumers have a choice about sustainable products? Or should all choices be more sustainable?
waste
1 out of 3 calories
Stranded Assets & Urban Agriculture

• In US & EU, most food waste is from fruits vegetables and seafood
• 30-40 years of life in many existing plants
• By-products—heat, CO2, warm water, brownfields
• MIT grows fresh vegetables for Cambridge
“it’s not if genetics, but which genetics”
Orphan crops

- Oil palm
- Millet
- Peanut
- Cowpeas
- Cassava
- Vine spinach
- Plantain
- Coco yam
- Sorghum
Rebuild soils

250 M hectares by 2030
1 liter of water = 1 calorie
Reward the best or move the rest?

- Government Regulation
- Voluntary Standards

Number of producers

Performance shift

Worse Average Better
Challenges for animal protein
World farmed fish & beef production, 1950-2014

Source: EPI based on FAO, USDA
Earth Policy Institute – www.earth-policy.org
# Poultry – efficiency matters

## Chicken – Global improvement evolution

<table>
<thead>
<tr>
<th></th>
<th>1925</th>
<th>1945</th>
<th>1965</th>
<th>1985</th>
<th>2005</th>
<th>2045*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion – kg feed/kg live</td>
<td>4.7</td>
<td>4.0</td>
<td>2.4</td>
<td>2.0</td>
<td>1.7</td>
<td>1.6</td>
</tr>
<tr>
<td>Mortality %</td>
<td>18%</td>
<td>10%</td>
<td>6%</td>
<td>5%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Age (days)</td>
<td>112</td>
<td>84</td>
<td>63</td>
<td>49</td>
<td>42</td>
<td>40</td>
</tr>
<tr>
<td>Live commercial weight - kg</td>
<td>1.0</td>
<td>1.4</td>
<td>1.6</td>
<td>1.9</td>
<td>2.4</td>
<td>3.2</td>
</tr>
</tbody>
</table>

*Source: Dr. Paul Aho, Novus Poultry Roundtable: Feeding the World and the Role of Poultry, January 2010*
Shift from maximizing one variable...

...to optimizing key ones
Climate change & food production
US Midwest land & climate suitability for cotton production, 2010-2100

Current  2040  2070  2100

Source: "The Effect Of Climate Change On Rural Land Cover Patterns In The Central United States", Christopher Lant, Timothy J. Stoebner, Justin T. Schoof, Benjamin Crabb, 2015
Suitability of cocoa production

Current

Suitability
- Barely
- Marginal
- Good
- Very good
- Excellent

Source: Armando Isaac Martinez, a.i.martinez@cgiar.org; Narioski Castro
Suitability of cocoa production

2030

Suitability change
- Much less
- Less suitable
- No change
- More suitable

Source: Armando Isaac Martinez, a.i.martinez@cgiar.org; Narioski Castro
In the short term, climate smart agriculture = efficient production.
In the medium term, producers change genetics
## When is a crop “broken?”

### Cocoa in Cote d’Ivoire – what are the trends?

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</thead>
<tbody>
<tr>
<td>Yield / hectare</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Down</strong></td>
</tr>
<tr>
<td>Illegal deforestation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Up</strong></td>
</tr>
<tr>
<td>% pods on a tree that mature for harvest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Down</strong></td>
</tr>
<tr>
<td>% producers above SDG poverty</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Down</strong></td>
</tr>
<tr>
<td>% trees infected with SSV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Up</strong></td>
</tr>
<tr>
<td>% C in soil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Down</strong></td>
</tr>
<tr>
<td>% farmers under 40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Down</strong></td>
</tr>
<tr>
<td>Child labor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Up</strong></td>
</tr>
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</table>
Is Business as Usual (BAU) a stretch goal?
Sustainability of raw materials, from niche to norm
2013: Global Salmon Initiative

70% of global production commits that all sales will be ASC certified by 2020
2012: Bord Bia and Ireland
Commit that all food exports will be certified by 2016
Long-term contracts

Product

Producers

Processors

Credit

Credit

IFC Credit

Other Credit

Global buyer of hamburger

Other meat markets

Long-term Contract
Inter-generational Land Transfers

• Global issue
• Every producer is concerned
• Governments care about food security
• Role of long-term contracts
Amazon and Whole Foods

- Impact on organic supply/demand
- Whole Foods organic to date
- “Waste” from sight unseen, returns policy
- Impacts on retail (e.g. scale, lifestyle, GHG)
The issue is risk both availability and reputation
Components of S&P 500 market value

Source: Ocean Tomo
Illegally in food

**FISHERIES**
- bluefin tuna
- demersal fishes
- shrimp and prawns

**AQUACULTURE**
- salmon
- shrimp
- tilapia

**LIVESTOCK**
- swine
- poultry
- cattle

**FOOD CROPS**
- palm oil
- soy
- cocoa

**NON-FOOD CROPS**
- pulp
- cotton
- rubber
Illegality – key issues

- Resource rights, access, concessions
- Labor and social issues
- Other laws and regulations
- Fraud
- Corruption
Research – Is illegality important for you?

- 8 companies’ supply chains
- 9 commodities, 8 countries
- All data in the public domain
- White paper drafted in September
- Goal: make illegality pre-competitive
What the research suggests

• 4 to 44% of target globally traded commodities are produced illegally

• Even greater % of domestic consumption produced illegally

• Using only one source of illegality, one country and data in the public domain
If a product is produced **illegally**, can it be **legal**?
If a raw material is produced illegally, can a product made with it be legal?
If a feed ingredient is produced illegally, can animal protein made from it be legal?
Traceability vs. Transparency
It isn’t just **where** a product is produced,

it’s **how** it’s produced
Traded commodities – then and now

19th & 20th Century
Physical values

- weights and measures
- brokens & quality
- color
- foreign matter
- health & safety, ppm, etc.

21st Century
Transparency values

- organic
- non-GMO
- no child labor
- zero deforestation
- water used
- income & SDG goals

Traded commodities – then and now
Key sustainability issues

• Productivity
  – Soil health; soil carbon
  – Genetics (drought & disease)

• Efficiency
  – Water, fertilizer and pesticides

• Food loss and waste
  – 2030 Goal – Reduce by 50%

• Consumption
  – Awareness of tradeoffs – fresh, off season, animal protein, etc.
Think about it.

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Technology & VC

Are they the solution?
R&D and VC—will our model solve our problems?

- Are the key problems technological?
- Can we agree on the biggest issues?
- Can we focus—X-Prize, other prizes
- Is pre-competitive VC possible at scale?