Is soil and water degradation inevitable? Don’t bet your life on it!

Soil and Water Conservation Society
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Rick Cruse
Iowa State University

NASA Visible Earth Program
Global grain stocks tighten, deluge in Australia

By Bruce Hextall
SYDNEY | Wed Jan 12, 2011 10:17pm IST

SYDNEY (Reuters) - Australia's worst floods in decades shut down a key grains port, while the United States signaled further tightening of domestic and global supplies, heightening fears over surging food inflation.

Corn and soybean futures in Chicago jumped to 30-month highs after the U.S. government reduced its estimate of corn and soybean production in the United States and Argentina, where hot, dry weather has begun to take a toll on crops.

Estimates of Australia's wheat crop and exports were also cut, at a time when there are concerns with the U.S. crop due to dry weather. Last year, Russia banned exports after the worst drought in a century decimated production.
The challenge to produce enough food will be greater over the next 50 years than in all human history

Figure 1. Explanatory notes:
- Based on data from FAOSTAT and UN Population Division, with simple scenario modelling from CSIRO 2009 (BA Keating, unpublished)
- Assumes growth trends in per capita food consumption growth in developing countries (currently 2668 kcal per capita per day) are maintained such that current developed country food consumption levels (3331 kcal per capita per day) are reached by 2050
- Assumes that diversion of food products (or production resources) to biofuels grows from current levels to 15% by 2050
- Assumes no food wastage prior to 1920 ramping up to current estimates of food wastage of 30% and these are not reduced going forward.
- A Petacal is 10^{15} calories, an Exacal is 10^{18} calories.
Demand for Higher Quality Food

- 3 billion people ➔ middle class (next 20 years)\(^1\)
- More meat – 73% ➔ by 2050\(^1\)

Meat Consumption, Soils & Water?

- 5 oz meat/day/capita – US¹
- Assume 3 billion eat 4 oz/day
- 750,000,000 lb meat/day
- ??? 1,300 lb beef animals

1,000,000 animals/day

WHY?

Supply/Productivity Limitations

- Land conversion
- 7% Ag land conversion by 2030

Table 4
Share of land use that remained the same, 1982-2007

<table>
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<tr>
<td>Forestland</td>
<td>98</td>
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<td>98</td>
<td>99</td>
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Worldwide Land Area

![Graph showing worldwide land area availability from 1960 to 2040. The x-axis represents the year, ranging from 1960 to 2040, while the y-axis represents land area per capita (ha), ranging from 0.10 to 0.45. The graph indicates a declining trend in land area available per capita over time.]
Brazil – Immense Untapped Capacity

- ~ 400,000,000 Ha yet to be developed
- ~ 15% lost to infrastructure for development
- ~ 340,000,000 Ha expansion potential
The Rest of the Story

- 7% world ag land converted by 2030\(^1\) ~ 342,000,000 Ha
- Brazil expansion ~ 340,000,000 Ha

Supply/Productivity Limitations

- 25% Agricultural land seriously degraded

FAO. 2011. State of the world’s land and water resources for food and agriculture. Summary Report. FAO. Rome
25% of Iowa’s row crop acres eroded at 20 – 100 times the soil renewal rate in 2007.

Average Soil Erosion (tons/acre)

Actual soil erosion rates for tilled, arable land in Europe are, on average, 3 to 40 times greater than the upper limit of tolerable soil erosion.¹

REST of the STORY

Erosion you see is NOT included!
Does soil erosion affect soil productivity?

Irrigation

- ~ 40% of world food comes from 18% of world’s cropland
  - India 3/5 of grain harvest
  - China 4/5 of grain harvest

Water Scarcity Index = 

**Human Fresh Water Consumption**

Renewable Fresh Water


Published by AAAS
Severe groundwater level declines (0.5-3 m/year) have occurred throughout northern China in the last three to four decades, particularly in deep aquifers.¹

- Irrigation
- Reservoir construction

High Plains Aquifer Depletion

Figure 19. Cumulative groundwater depletion in the High Plains aquifer, 1900 through 2008.

Climate change & food security?

- Climate Change From 1980 - 2008¹
  - Wheat production reduced 5.5%
  - Maize production reduced 3.8 %

Projected Patterns of Precipitation Changes

IPCC Fourth Assessment Report Summary for Policy Makers
Annual temperature trends: 1976 to 2000

Trends in °C per decade

-1  -0.8  -0.6  -0.4  -0.2  0  +0.2  +0.4  +0.6  +0.8  +1

SYR - FIGURE 2.6b
Mean surface temperature in Europe 1850-2009, annual and by season¹.

Harvests in Illinois and Indiana, two major producers, were lower in years with average maximum summer (June, July, and August) temperatures that were higher than the 1980-2007 average.

Performanc

=????
Working Lands

Our agricultural lands must work.
Take Away Message

- **Remaining** soil and water resources
  - Are critical for global food security
  - Are economically imperative for rural areas everywhere
  - Will increase in importance
  - Are not replaceable and have no substitute

- Maintaining existing resources will require proactive approach
Challenges we face

- What evidence exists that we are on a functionally sustainable path?
- If not on a sustainable path do we have a vision of what that path is?
- Do we have the political will to address the causes rather than the symptoms of our current problems?
Ag Realities

- **Agriculture** if morphing to **Agribusiness**
  - Fewer farmers control more
  - Enterprise size is increasing
  - Culture is multidimensional, business is less so

- Farming is very competitive

- Successful farmers make money
Ag Realities

- Voluntary conservation approaches work best when incentives and benefits are aligned

- Majority of harvested land is rented
  - Conservation incentives and benefits are not well aligned

- Markets are farmed, not the land
Ag Realities

- Very strong ag and industry lobby
  - Rationally not aligned with conservation goals
  - Aligned with $$$ for individual industry

- Major policy elements not well aligned with soil conservation and water quality

- Soil erosion science is weak
Ag Realities

Frequency

Conservation  Exploitation
What’s New

- Increased watershed focus
- Industry recognition of sustainability issues
- Food industry talking the talk – will they walk the walk?
- Farmers vocalizing the ‘R’ word
- Increased emphasis on cover crops
What’s not new

- Specialization
- Loss of cultural based management skills and increasing reliance on technology
- Growth in size of operations and equipment
What’s not new

• Government policy in conflict with conservation

• Degradation of soil and water resources
Elements of a fix

- Goal and a Plan
  - Commitment to those goals
  - Agriculture and agribusiness are different and must be treated as such
- Policies
  - That do not put conservation committed farmers at a competitive disadvantage
- Address the problem, not the symptom
  - Exploitation at expense of conservation