Recent Global Agriculture Production Trends

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Outline

➢ Future NASA (Cooperative) Satellite Systems and Notable Product Improvements

➢ Global Soybean, Corn, and Wheat Production

➢ Global Warming Risk to Global Crop Production
  ➢ Record Maximum Temperatures in Northern Hemisphere during July/August
  ➢ Example: Record maximum temperatures in Russia during July/August 2010.
Near Future Observations

- Surface soil moisture (SMMR, TRMM, AMSR-E, SMOS, Aquarius, SMAP)
- Snow water equivalent (AMSR-E, SSM/I, SCLP, GCOM-W, MIS)
- Snow cover fraction (MODIS, VIIRS, MIS)
- Water surface elevation (Jason-2, SWOT)
- Terrestrial water storage (GRACE, GRACEII)
- Land surface temperature (MODIS, AVHRR, GOES, ...)
- Precipitation (TRMM, GPM)
- Radiation (CERES, CLARREO)
- Vegetation/Carbon (Landsat, AVHRR, MODIS, VIIRS, MetOp, DESDynl, ICESat-II, HyspIRI, LiST, ASCENDS)

Source: Modified from NASA- Peters-Lidard slide
October 13, 2010
Global Forest Canopy Heights

A first-of-its-kind global map shows forest canopy height in shades of green from 0 to 70 meters (230 feet). For any patch of forest, the height shown means that 90 percent or more of the trees in the patch are that tall or taller. Areas without forest are shown in tan. Credit: NASA Earth Observatory/Image by Jesse Allen and Robert Simmon/Based on data from Michael Lefsky.

› View larger image
US Forest Canopy Heights

2009 Cropland Data Layers

Land Cover Categories (by decreasing acreage)

Agriculture
- Pasture/Grass
- Corn
- Soybeans
- All Wheat
- Other Hays
- Fallow/Idle Cropland
- Alfalfa
- Cotton
- Other Crops
- Sorghum

Non-Agriculture
- Woodland
- Shrubland
- Urban/Developed
- Wetlands
- Water
- Barren
- Perennial Ice/Snow

January, 2010
Resolution=56-m

Midwest Corn & Soybean Belt
Wheat
Cotton
Rice
2010 Global Soybean Production

Western Hemisphere

2010 Top 5 Producers

<table>
<thead>
<tr>
<th></th>
<th>Soybean Production (1000 tons)</th>
<th>Percent of World (%)</th>
<th>Soybean Export (1000 tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>255257</td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>92756</td>
<td>36</td>
<td>41368</td>
</tr>
<tr>
<td>Brazil</td>
<td>67000</td>
<td>26</td>
<td>31400</td>
</tr>
<tr>
<td>Argentina</td>
<td>50000</td>
<td>20</td>
<td>12000</td>
</tr>
<tr>
<td>China</td>
<td>14400</td>
<td>6</td>
<td>55</td>
</tr>
<tr>
<td>India</td>
<td>9200</td>
<td>4</td>
<td>450</td>
</tr>
</tbody>
</table>

Source: PSD Online
http://www.fas.usda.gov/psdonline/
October 13, 2010
China Soybean Imports

Global Soybean Imports

Soybean Trade Surpassed Wheat & Coarse Grains after 2001
2008 U.S. Grain Export Movement by Vessel

Pacific Northwest
32.202 mt (33 %)

Great Lakes
1.44 (1.5 %)

Atlantic Coast
2.06 (2 %)

Mississippi River
50.780 (52 %)

Texas
11.341 (11.5 %)

Interior Shipments to Mexico
Soil and high rainfall rates required greater volumes of fertilizers (kg/ha) and no-till farming to reduce erosion.
Brazil Soybean Yields Are Similar to USA

Historical Soybean Yields for U.S. and Brazil

Data Source: USDA's NASS and PSD Online
Global Corn Production

Source: PSD Online
http://www.fas.usda.gov/psdonline/
October 13, 2010

2010 Top 5 Producers

<table>
<thead>
<tr>
<th>Country</th>
<th>Corn Production (1000 tons)</th>
<th>Percent of World Export (percent)</th>
<th>Corn Export (1000 tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>819648</td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>321679</td>
<td>39</td>
<td>50802</td>
</tr>
<tr>
<td>China</td>
<td>166000</td>
<td>20</td>
<td>200</td>
</tr>
<tr>
<td>EU-27</td>
<td>54955</td>
<td>7</td>
<td>500</td>
</tr>
<tr>
<td>Brazil</td>
<td>51000</td>
<td>6</td>
<td>7000</td>
</tr>
<tr>
<td>Argentina</td>
<td>25000</td>
<td>3</td>
<td>17500</td>
</tr>
</tbody>
</table>
Mississippi River Barges Carrying Grain
Figure 10

Barge Movements on the Mississippi River¹ (Locks 27 - Granite City, IL)

1 The 3-year average is a 4-week moving average.

Source: U.S. Army Corps of Engineers (www.mvp.usace.army.mil/mvrimi/omni/webpts/default.asp)

Week ending July 31: Down 34% from last year, and down 10% compared to the 3-yr average.
Global production gains from increased yields

Slight gain in global crop area

Food Insecure Countries

Figure 1

In 37 (out of 70) developing countries, over 40% of the population is estimated to be food insecure

Lower income countries where 40% of the population is food insecure¹, 2010

Legend
- Study countries
- Study countries with > 40% of the population food insecure
- Non-FSA countries

¹Defined as consumption below the nutritional target of roughly 2100 calories per person per day.
Yields still increasing in the US

“Green Revolution” of hybrid seeds, fertilizers, etc. has not arrived in Africa

Source: PSD Online
http://www.fas.usda.gov/psdonline/
Reduce Yield Gap (Potential vs. Actual) in Africa

Seed Production for Agro-climates

Data Source: Pannar Seeds and CIMMYT Maize Atlas

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USDA/FAS/OGA
## Seed Varieties Often Distributed to Incorrect Agro-climates

### Crop Adaptation to Elevation in Ethiopia

*from De Pauw and Bruggeman, 1988*

<table>
<thead>
<tr>
<th>Thermal Zone/Traditional Name/Elevation</th>
<th>Cereal and Legume Crops Grown</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6 = High Wurch (&gt;3700m)</td>
<td>Barley, oats, faba bean, faba pea, linseed, rapeseed</td>
</tr>
<tr>
<td>T5 = Wurch (3000-3700m)</td>
<td>Wheat, barley, teff, oats, sunflower, chickpea, lentil, faba bean, faba pea, linseed, rapeseed</td>
</tr>
<tr>
<td>T4 = Dega (2300-3000m)</td>
<td>Millet, maize, sorghum, rice, wheat, barley, teff, oats, cowpea, sunflower, haricot bean, chickpea, lentil, faba bean, faba pea, nigerseed</td>
</tr>
<tr>
<td>T3 = Weyna Dega (1500-2300m)</td>
<td>Millet, maize, sorghum, rice, cowpea, sunflower, safflower, sesame, haricot bean</td>
</tr>
<tr>
<td>T2 = Kolla (500-1500m)</td>
<td>Millet, maize, sorghum, rice, cowpea, sunflower, safflower, sesame, haricot bean</td>
</tr>
<tr>
<td>T1 = Bereha (&lt;500m)</td>
<td>Millet, maize, sorghum, rice, cowpea, sunflower, safflower, sesame</td>
</tr>
</tbody>
</table>

Note: Elevation increments (y-axis) not drawn to scale.
Multi-tiller Corn Hybrids in South Africa

4-5 cobs per stock
2010 Global Wheat Production

Northern Hemisphere where temperatures are cooler.

2010 Top-5 Producers

<table>
<thead>
<tr>
<th></th>
<th>Wheat Production (1000 tons)</th>
<th>Percent of World (percent)</th>
<th>Export (1000 tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>641444</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EU-27</td>
<td>135630</td>
<td>21</td>
<td>21000</td>
</tr>
<tr>
<td>China</td>
<td>114500</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>80710</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>60514</td>
<td>9</td>
<td>34019</td>
</tr>
<tr>
<td>Russia</td>
<td>42500</td>
<td>7</td>
<td>3500</td>
</tr>
</tbody>
</table>

Source: PSD Online
http://www.fas.usda.gov/psdonline/

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USDA/FAS/OGA
October 13, 2010 USDA/FAS/OGA

Why Monitor Global Crop Production with Satellites & USDA/WASDE Report?


Early 1970’s price hike.

July/Aug 2010 drought in Russia did not raise wheat prices to 2007 levels due to greater stocks.

Source: USDA/ERS: September 21, 2010
http://www.ers.usda.gov/Data/Wheat/Yearbook/WheatYearbookTable18-Full.htm
Why Monitor Global Crop Production with Satellites and USDA/WASDE Report?

Global Wheat Stocks/Use Ratio

Data Source: USDA's PSD Online
http://www.fas.usda.gov/psdonline/
Global Warming Effects On Agriculture

Record July/August temperatures over major grain belts can spike prices. Floods damage crops but not at large scale as droughts over grain belts.

Long-term fluctuations in weather patterns could have extreme impacts on agricultural production, slashing crop yields and forcing farmers to adopt new agricultural practices in response to altered conditions.

Source: http://jrscience.wcp.muohio.edu/climatechange02/ProposalArticles/lkhgd.html
Temperature Anomalies in Russia (July & August, 2010)

Record July/August temperatures in Russia’s wheat belt.

Source: Weather Predict
Precipitation Percentile

North April 1 - August 8, 2010

Legend

Percentiles
- 99+ (Wettest)
- 95
- 90
- 85
- 70
- 30 to 70
- < 30
- < 20
- < 10
- < 5
- < 2 (Driest)
- NO Data

Intensities:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Crop Areas:
- Sunflower

USDA Agricultural Weather Assessments
World Agricultural Outlook Board

August 12, 2010
Satellite-derived vegetative indices indicate that crop conditions are significantly worse than normal in nearly every major crop-production region of Russia and Kazakhstan. Persistent drought and excessive heat have reduced yield prospects for all crops.

Below average vegetation health due to warm temperatures and drought.
Russia: Wheat Production 1961-2010

Red columns indicate record output (1968 for spring wheat, 2008 for winter.)
Winter wheat experienced warm temperatures for only a few days during grain filling stages (May 15-June 15, 2010).
Russia: Area, Yield, and Production of Wheat

Winter wheat production did not dip to 25 MMT as in 1998.
Summary

• 2010 Northern Hemisphere harvest is almost complete & commodity markets currently looking at Southern Hemisphere crops.

• Future record high temperatures during July/August in Northern Hemisphere could be devastating to world prices if drought’s epicenter is located directly over major grain belts
  – US Midwest where ~300MT of corn is produced
  – EU and Russia Wheat Belts

• Global stocks near low levels of early-1970’s
  – Capacity of ocean vessel traffic is much larger now than in the 1970’s.

• Producers will respond to increased prices to meet global demands.
  – Commodities flow towards money & not towards the rural poor who are food insecure and do not have cash reserves.
Global Corn Yields


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Global Wheat Yields


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