Vegetation Health Applications in USDA

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1972 Soviet Grain Purchases

Former National Security Advisor Henry Kissinger had this to say about record July 1972 Soviet grain purchases from the United States:

• “Our intelligence about Soviet needs was appalling.

• Our knowledge of what was happening in our markets was thin.

• The U.S. Government was simply not organized at the time to supervise or even monitor private grain sales as a foreign policy matter.”
Global wheat supplies for 2012/13 are projected 3.1 million tons lower mostly due to lower expected production in Russia. An increase in foreign beginning stocks partly offsets the projected 4.1-million-ton reduction in world wheat output. Beginning stocks are raised for Canada and Egypt, but lowered for Argentina. Production for Russia is reduced 4.0 million tons with lower reported area and reduced yields as harvest results confirm additional drought and heat damage to both the winter and spring wheat crops. Production is also lowered 0.5 million tons for adjoining Kazakhstan, which experienced the same adverse drought and heat during July and August that affected spring wheat in the central and eastern growing regions of Russia. 

EU-27 production is lowered 0.5 million tons mostly reflecting lower expected yields in the United Kingdom. Ukraine production is raised 0.5 million tons based on higher reported yields. Production for Afghanistan is raised 0.4 million tons mostly on higher reported area.
USDA’s Economic Intelligence System

- National Agricultural Statistics Service
- Joint Agricultural Weather Facility
- Foreign Agricultural Service
- Economic Research Service
- Farm Service Agency

World Agricultural Outlook Board

- Domestic Production and Stocks Estimates
- Weekly Weather and Crop Bulletin

World Agricultural Supply and Demand Estimates

ERS Situation and Outlook Reports

Long-term Baseline Projections

Agricultural Weather Assessments
World Agricultural Outlook Board
* Random sampling of available daily weather data

* Most have data since at least 1982 (many with normals)

Location of weather stations received daily via the WMO

1 United Nations World Meteorological Organization
The maps above highlight the differences that arise using WMO data, which are sparse in coverage, versus the supplemental rain gauge data, which provides a denser network of stations and a better representation of rainfall.
Comparison with other sources of information, including satellite derived estimates (CMORPH), support the rain gauge analysis.
Percent of Average Precipitation (Prairie Region)

April 1, 2016 to August 8, 2016

Produced using near real-time data that has undergone initial quality control. The map may not be accurate for all regions due to data availability and data errors.

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Prepared by Agriculture and Agri-Food Canada's National Agroclimate Information Service (NAIS). Data provided through partnership with Environment Canada, Natural Resources Canada, and many Provincial agencies.

Created: 08/09/16
www.agr.gc.ca/drought
Cumulative Precipitation

9 - SASKATCHEWAN - SOUTHWEST

Agricultural Weather Assessments
World Agricultural Outlook Board
Vegetative Health Index (4km)
July 22, 2016

Source: NOAA/NESDIS
Australia: Wheat

- Yellow numbers are percentages, representing the average annual contribution of each state to the total national production. States not numbered contribute less than 1% to the national total.
- Major crop areas combined account for approximately 75% of the total national production annually.
- Major and minor crop areas combined account for approximately 99% of the total national production annually.

Source: Major and minor agricultural areas and state percentages are derived from 2010-11 Agricultural Census data, obtained from the Australian Bureau of Statistics (ABS), and data obtained from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES).

This product was developed by the USDA Office of the Chief Economist (OCE) World Agricultural Outlook Board (WAOB).
Adequate to abundant rainfall throughout most of the growing season has resulted in a high yielding crop.
Similarly, combination of adequate to abundant soil moisture at the beginning of the growing season, and near-normal rainfall through mid-September... appeared to help heat withstand untimely heat and dryness later in growing season.
VHI data – Week 42
(7 day period ending Oct 21)

Note – Prelim data available Oct 22
Final data available Dec 3

...these favorable signals lie within major wheat producing areas.
Vegetation Health Index vs. Wheat Yields

South Australia

Based on 13 years of data (2002-2014)

VHI data – Week 32
(7 day period ending Aug 12)

Note – Prelim data available Aug 13
Final data available Sep 24

$R^2 = 0.10$
Vegetation Health Index vs. Wheat Yields

South Australia

VHI data – Week 33
(7 day period ending Aug 19)

Note – Prelim data available Aug 20
Final data available Oct 1

Based on 13 years of data (2002-2014)

$R^2 = 0.19$
Vegetation Health Index vs. Wheat Yields

South Australia

Based on 13 years of data (2002-2014)

VHI data – Week 34
(7 day period ending Aug 26)

Note – Prelim data available Aug 27
Final data available Oct 8

$R^2 = 0.35$
Vegetation Health Index vs. Wheat Yields
South Australia

Based on 13 years of data (2002-2014)

VHI data – Week 35
(7 day period ending Sep 2)

Note – Prelim data available Sep 3
Final data available Oct 15

R² = 0.49
Vegetation Health Index vs. Wheat Yields

*South Australia*

Based on 13 years of data (2002-2014)

VHI data – Week 36
(7 day period ending Sep 9)

Note – Prelim data available Sep 10
Final data available Oct 22

\[ R^2 = 0.61 \]
Vegetation Health Index vs. Wheat Yields

South Australia

Based on 13 years of data (2002-2014)

VHI data – Week 37
(7 day period ending Sep 16)

Note – Prelim data available Sep 17
Final data available Oct 29

Yield (vs. trend)

$R^2 = 0.74$
Vegetation Health Index vs. Wheat Yields

South Australia

Based on 13 years of data (2002-2014)

VHI data – Week 38
(7 day period ending Sep 23)

Note – Prelim data available Sep 24
Final data available Nov 5

$R^2 = 0.84$
Vegetation Health Index vs. Wheat Yields

South Australia

Based on 13 years of data (2002-2014)

VHI data – Week 39
(7 day period ending Sep 30)

Note – Prelim data available Oct 1
Final data available Nov 12

$R^2 = 0.88$
Vegetation Health Index vs. Wheat Yields

South Australia

Vegetation Health Index vs. Wheat Yields

South Australia

VHI data – Week 40
(7 day period ending Oct 7)

Note – Prelim data available Oct 8
Final data available Nov 19

$R^2 = 0.91$

Based on 13 years of data (2002-2014)
Vegetation Health Index vs. Wheat Yields

South Australia

Based on 13 years of data (2002-2014)

VHI data – Week 41
(7 day period ending Oct 14)

Note – Prelim data available Oct 15
Final data available Nov 25

$R^2 = 0.92$
Difference between VHI-based and final yield estimates

Diff ≤ 0.02 t/ha, 31% (4/13 years)
Diff ≤ 0.08 t/ha, 70% (9/13 years)
Diff ≤ 0.13 t/ha, 100% (13/13 years)

Current VHI-based estimate = 1.87 t/ha
Vegetation Health Index vs. Wheat Yields

The relationship between VHI and wheat yields is strong in these states as well...

Western Australia: $R^2 = 0.87$ (week 44)

Victoria: $R^2 = 0.92$ (week 42)

New South Wales: $R^2 = 0.91$ (week 42)

Queensland: $R^2 = 0.70$ (week 42)
## VHI-derived and ABARES Yield Estimates

### Winter Wheat

<table>
<thead>
<tr>
<th></th>
<th>ABARES area (ha)</th>
<th>VHI yield (t/ha) prod (Mt)</th>
<th>ABARES yield (t/ha) prod (Mt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Australia</td>
<td>5,150,000</td>
<td>1.71 8.8</td>
<td>1.69 8.7</td>
</tr>
<tr>
<td>South Australia</td>
<td>2,360,000</td>
<td>2.09 4.9</td>
<td>1.85 4.4</td>
</tr>
<tr>
<td>Victoria</td>
<td>1,625,000</td>
<td>1.61 2.6</td>
<td>1.54 2.5</td>
</tr>
<tr>
<td>New South Wales</td>
<td>3,900,000</td>
<td>2.08 8.1</td>
<td>1.82 7.1</td>
</tr>
<tr>
<td>Queensland</td>
<td>750,000</td>
<td>1.69 1.3</td>
<td>1.67 1.3</td>
</tr>
<tr>
<td><strong>National Estimate</strong></td>
<td><strong>13,785,000</strong></td>
<td><strong>1.87 25.7</strong></td>
<td><strong>1.74 24.0</strong></td>
</tr>
</tbody>
</table>
In order to accurately interpret satellite-derived imagery, it is imperative to know the crop-growing regions, crop calendars, and development stage. WAOB meteorologists have acquired crop-production data, planting dates, and proven GDD-based methodology to assist this effort.
From the August 2017 Lockup:

“In mid- to late-June, as the crop was flowering (north) to filling (south), the VHI supported excellent – perhaps even record-setting – winter wheat yields for a second straight year.”
A relatively new effort, we are using GDD-based crop stage and corresponding weather to fine tune weather-crop impacts.

*Based on Mean Planting Date
This past week’s heat did not linger, with only two days above 37°C (99°F). Rain prior to the heat also aided the crop’s heat tolerance.
Expanding on this technique, we are using Wx data & corresponding GDD-based crop stage in conjunction with VHI admin-level ascii data and extracting a stage-specific VHI.
Scenarios (VHI @ various crop stages) are tested, looking for the best fit. In the case of Ukraine, the VHI alone (left) does not score well, but when paired with trend (below) it scores very high at Silk and Blister.
In some places – like Ukraine – the VHI alone does not tell the story.
The VHI (@ onset of Blister) paired with Wx, Trend, as well as an adjustment for a technology shift ~ 2007, shows significant skill.
Hindcast validates our confidence.
The final adjusted Regression Forecast (VHI, Wx, and Trend) gave us a yield of 6.26; this was taken into account when the USDA/WAOB Grains Chairperson set the final Ukraine Corn Yield forecast for August (6.33).
Thank You!

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