Global Agriculture and Drought Monitoring

Center for Global Agricultural Monitoring Research, Department of Geographical Sciences, UMD

PI: Inbal Becker-Reshef

NASA Water Resources PI Meeting, July 18-19, 2017
Challenge

• Provision of timely, reliable, policy-relevant crop condition assessments that reflect and international consensus
  – For countries most at risk for food insecurity
  – For main food producing and export countries

• Bridging gap between EO and ag policy and econ communities
  – Ensuring that EO products are developed according to needs of user community
Opportunity

• G-20 Policy Mandate reaffirmed in 2016 and 2017 with well defined, active user communities

• Bring international operational community to develop consensus reports, reducing uncertainty and increasing confidence in crop assessments, for informing agricultural policy, and food security decisions
  – Increase the use of EO based information, products to inform decisions on food security, policy and markets
  – Foster closer working relationship between the EO ag community and the economics/policy community, creating a demand for EO based information
Framework: G20 GEOGLAM Initiative

A coordination initiative aimed at strengthening the international community’s capacity to provide actionable, science-driven, open, information at sub-national to global scales, in support of policies, investments and decisions, in food security, and agricultural markets within the broader context for sustainable development and climate change.

- Building on existing national and global systems
- Through use of coordinated, satellite Earth Observations
  - www.geoglaml.org
EWCM vs. AMIS Countries

- AMIS Croplands
- Early Warning Croplands
- Early Warning & AMIS Overlaps
Current partners and user community

- Range of user communities and partners:
  - **Crop Monitor for the Agricultural Market Information System (AMIS)**
    - USER: AMIS, representing policy and econ communities
    - Focus on the main production/export countries
    - Informing international markets, in support of market stability and reduced volatility
    - Over 35 international, regional and national partners
  - **Crop Monitor for Early Warning**
    - User: Humanitarian aid, and early warning communities
    - Focus on countries at risk of food insecurity
    - Current partners include the main international agencies concerned with monitoring food security, national ministries and regional organizations
  - **Regional Crop Monitors**
    - IGAD/ICPAC, focus on East Africa, run by national partners (in development)
    - Latin America- currently in discussion
  - **National Crop Monitors**
    - Focus on subnational conditions for informing national policy
    - Tanzania – Ministry of Agriculture National Food Security Division
    - Uganda – Office of the Prime Minister
Project Title: Global Agriculture and Drought Monitoring

Crop Monitor for AMIS contributing partners

> 35 Partners
Crop Monitor for Early Warning overview

- Grew out of the success of the AMIS Crop Monitor
- Objective: exchange information, build consensus and reduce uncertainty in countries most vulnerable to food insecurity, to strengthen agricultural decision making
- 11 food security crops
- Recognition even more pressing need for enhanced, reliable, vetted information on crop conditions within countries at risk
- Response to early warning community’s request
- Significantly progressed and gained international recognition since launch in 2016
  - Grew from 3 to 11 partners
  - Published 17 issues
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**Crop Monitor for Early Warning partners**

- Priority to expand to include regional network and national partners including ministries of agriculture

*EC contribution is provided by the Joint Research Centre of the European Commission*
Key datasets, models, scientific, technical tools
Examples of the available EO Data layers
Including several from NASA Applied Sciences Projects

USGS – Actual ET Anomaly

USGS/CHG – CHIRPS Rainfall Anomaly

USGS/CHG – CHIRPS Total Rainfall

UMD/NASA – NDVI Anomaly

JRC – Rainfall Sum Anomaly

JRC – Temp Sum Anomaly

TU WIEN – Soil Water Index Anomaly

NASA/USDA – Soil Moisture Anomaly

NOAA/USDA ARS – ESI
GEOGLAM Best Available Multi-Season Crop Masks

Winter Wheat

Spring Wheat

Rice

Maize

Soybeans
**Project Title: Global Agriculture and Drought Monitoring**

**GEOGLAM Best Available Multi-Season Crop Calendars**

- Built USDA and FAO crop calendars and refined with inputs from our in-country partner agencies at a sub-national level.
- Broken down into crop stages to help identify critical periods of development.
- Recent release of joint AMIS-GEOGLAM Crop Calendars.

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**AMIS - GEOGLAM Crop Calendar**

<table>
<thead>
<tr>
<th>Selected leading producers</th>
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</thead>
<tbody>
<tr>
<td>Wheat</td>
</tr>
<tr>
<td>EU (21%)</td>
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<tr>
<td>China (17%)</td>
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<tr>
<td>India (13%)</td>
</tr>
<tr>
<td>US (8%)</td>
</tr>
<tr>
<td>Russia (8%)</td>
</tr>
<tr>
<td>Maize</td>
</tr>
<tr>
<td>US (35%)</td>
</tr>
<tr>
<td>China (22%)</td>
</tr>
<tr>
<td>Brazil (8%)</td>
</tr>
<tr>
<td>Argentina (3%)</td>
</tr>
</tbody>
</table>

**Soybeans**

- USA (31%)
- Brazil (29%)
- Argentina (18%)
- China (4%)
- India (3%)

**Rice**

- China (29%)
- India (21%)
- Indonesia (9%)
- Vietnam (6%)
- Thailand (4%)

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*Percentages refer to the global share of production (average 2013-15).*

- **Planting (peak)**
- **Planting**
- **Growing period**
- **Weather conditions in this period are critical for yields.**
- **Harvest (peak)**
- **Harvest**
- **Multiple reasons**

**Initial Comparison of Calendars with RS**
Crop Interface for Crop Condition Assessments

AMIS: 6,566 crop condition reports submitted since May, 2014

EW: 5,550 crop condition reports submitted since January, 2016
Products: Maps

Quick and easy to interpret crop conditions
Oriented for the non RS community
Project Title: Global Agriculture and Drought Monitoring

Products: Pie Charts

Share of total AMIS Exports

Share of total AMIS Production

- Exceptional
- Favourable
- Watch
- Poor
- Out-of-Season
- No Data

Drivers:
- Wet
- Dry
- Hot
- Cool
- Extreme Event
Approach

1. Partners submit crop condition information, data, and fill out information on the online Crop Assessment Tool
2. Compile submitted information into a report and produce discrepancy maps
3. Review and discuss report and discrepancies over partner telecon
4. Update assessment and send out for GEOGLAM review
5. Submit draft for AMIS review (AMIS CM) or for partner review for the EWCM
6. Update if new information becomes available prior to release
7. Release both Crop Monitors on the first Thursday of the month

Total process is ~ 10 days
Monthly Telecons focus on Discrepancies
Example from East Africa, Maize 1

Discrepancies:
1: North Somali
- FEWS NET: Favourable
- WFP: Favourable
- FAO GIEWS: Exceptional
- Last Month: Watch-Dry, Delayed Onset

2: Afar, Ethiopia
- FAO GIEWS: Watch-Dry
- WFP: Watch-Driver?
- FEWS NET: Favourable
- Last Month: Favourable

SNNPR, Ethiopia
- FEWS NET: Watch-Delayed Onset
- WFP: Favourable
- FAO GIEWS: Favourable
- Last Month: Watch-Dry, Delayed Onset

East Oromia, Ethiopia
- FAO GIEWS: Favourable
- FEWS NET: Watch-Delayed Onset
- WFP: Watch-Driver?
- Last Month: Watch-Dry, Delayed Onset

Note: Some Discrepancies have been lumped together for the purpose of discussion
Example: May Assessment Numbers & Maps

- 7 agencies participated
  - JRC, Asia RiCE, FEWS NET, ICPAC, FAO GIEWS, WFP, ARC
- 688 entries over 61 countries covering 14 different crops
- 198 overlap regions between agencies
- 25 sub-national regions with crop condition discrepancies
  - Primarily covering Maize 1 in East and Southern Africa
- 26 sub-national regions with changing crop conditions – positive or negative change
Most Recent Early Warning Assessment over Africa (June 28th)

Africa & Yemen: Synthesis

Conditions:
- Exceptional
- Favourable
- Watch
- Poor
- Failure
- Out-of-Season
- No Data

Countries:
- Early Warning African Countries
- Non-Early Warning African Countries

Crops:
- Maize
- Sorghum
- Millet
- Beans
- Wheat
- Rice
- Cassava
- Barley
- Teff
- Groundnut
GEO's US Co-Chair, Dr Kathryn Sullivan, Administrator of the US National Oceanic and Atmospheric Administration (NOAA), stated, “Concerns over food and water security are rising globally. Ensuring that agricultural industries around the world have access to the best science, data, tools and resources is essential as we work to increase food security and mitigate the effects of droughts and floods. The GEOGLAM Early Warning Crop Monitor provides decision-makers with essential information, gathered from satellites, buoys and other observational tools, to be ready, responsive and resilient against extreme weather and water events.”
Already informing agricultural decisions

South African corn withers amid worst drought on record

Agricultural Commodities

Impact of evidence provided by FEWS NET to support decisions and anticipate the crisis

FEWS NET and WFP have been working closely.

Financial Times

Joint Statement
**Project Title: Global Agriculture and Drought Monitoring**

**Products: Crop Monitor for AMIS**

Published monthly within the Market Monitor
(41 issues published)

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**Crop conditions in AMIS countries (as of February 28th)**

**Conditions at a glance**

**Wheat** - In the southern hemisphere, the season has ended with mixed conditions. In the northern hemisphere, the winter crop is still mostly dormant in the majority of countries. Conditions are overall favourable at this early stage of the season. However, concerns continue in parts of Ukraine due to the poor establishment conditions in autumn, which also led to a reduced planted area.

**Maize** - In the southern hemisphere conditions are mostly favourable with the exception of South Africa where conditions remain poor over large parts of the country due to the severe drought attributed to El Niño. There are some concerns due to lack of rain in northern Brazil. The northern hemisphere is largely out of season with the exception of India and Mexico where conditions are favourable.

**Rice** - Conditions remain mixed in Southeast Asia in part due to the impacts of El Niño which is having a severe impact on Thailand where conditions remain poor. Conditions are generally favourable in all other countries.

**Soybeans** - Conditions in the southern hemisphere remain favourable with only a few localized issues. The northern hemisphere is currently out of season.

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**From El Niño to a possible La Niña**

The ongoing El Niño persisted in 2015 and is now in decline, with forecast models indicating that the transition to neutral conditions will be complete by about June. Drought is expected to continue in Southeast Asia and across northern South America, including northeast Brazil. In Southern Africa, drought impacts on crop production are widespread and severe. This has led to the issuance of a joint statement on regional food insecurity by the World Food Program, FEWS NET, the European Commission, and FAO (http://www.feednet/southeast- asia/african/february2016). In southeastern Brazil and Uruguay, abundant rainfall is expected to continue. In Central Asia, the expected above average precipitation has not materialized, and winter snow pack is now below normal. In northern California, snowfall has not occurred, and remains in the grip of drought, accompanied by hot temperatures. Northern California has fared somewhat better, but not well enough to emerge from multi-year drought. The Great Lakes region is expected to continue to be warmer and drier than usual through spring. No major El Niño impacts are anticipated in the main summer growing season of the U.S., Canada, Europe, and western Russia. Therewith, neutral conditions should persist through the latest quarter of 2015, or we could see transition to La Niña. Odds of reverting to El Niño are low. A reversion of past El Niño events and model projections for October-December 2015 puts the probabilities at approximately 50 percent for La Niña, 40 percent for neutral, and 10 percent for El Niño.

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**Soybeans**

In Brazil, the crop is largely vegetative to reproductive stages in the southern, north and northeast regions and is in flowering through harvest stages in the rest of the country. The crop is in record condition in the north and northeast due to a lack of rainfall but favorable in the rest of the country. In Argentina, conditions remain mostly favorable but there are some areas affected by excess moisture from this month and lingering dry issues from January. The first crop is mostly in grain filling to maturity stages, and the second crop is in flowering to grain filling stages.
Crop Monitor for Early Warning
Published monthly at the same time as the Market Monitor
(18 issues published)
Development of National Crop Monitors, Facilitating National Food Security Reports

Interest for developing national Crop Monitors from several ministries of agriculture including Kenya, Argentina & Brazil

Currently developing a regional bulletin for East Africa with IGAD/ICPAC


The Inter-Ministerial/Agencies Monthly National Integrated Multi-Hazard Early Warning Bulletin, published by the Uganda Office of the Prime Minister
Lessons Learned

- Working closely with user community is critical!
  - Understanding user needs- took over a year to develop jointly the current crop monitor maps and charts working closely with the economics/policy community
- Ensure appropriate R&D informs the development of the system
- Information products have to be simple!
- Done is better than perfect
  - Became operational first and evolve products and process as we go
- Community building
- Much that the RS community can offer the policy community- critical to build bridges, and continue to work together
In Summary

- We have come a long way in short period of time!
- **Public good**: open, timely, actionable info on crop conditions
- Consensus help to prevent confusion, uncertainty and speculation
- **International cooperation** and information sharing on an in-kind basis is critical
  - First time international community comes together on a monthly basis
- Significant progress in bridging the gap between Remote Sensing and Economics communities
- Increasing communication and knowledge transfer amongst national, regional & int. organizations
  - Thereby strengthening national monitoring systems
  - Monthly communication & discussion helped foster strong working relationships and trust amongst partners
- **End user driven** with strong community & high level support
- Internationally recognized as a highly valuable source of information
  - Already informing decisions
Publications

Operational Monthly Publications

• GEOGLAM Crop Monitor for Early Warning, 18 bulletins published (www.cropmonitor.org)

Peer Reviewed

Selected News, Press Releases, Official Reports


- Globe and Mail (Canada) print version only, Devastating drought threatens to unravel economic growth in Africa. February 16, 2016.

- Financial Times. South African corn withers amid worst drought on record. February 10, 2016. [https://next.ft.com/content/c8818670-cfd0-11e5-92a1-c5e23e99c77](https://next.ft.com/content/c8818670-cfd0-11e5-92a1-c5e23e99c77)


Crop Monitor website for additional information

www.cropmonitor.org

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Brian Barker: bbarker1@umd.edu
<table>
<thead>
<tr>
<th>Condition</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Exceptional</td>
<td>Conditions are much better than average* at time of reporting. This label is used only during the grain-filling through harvest stages.</td>
</tr>
<tr>
<td>Favourable</td>
<td>Conditions range from slightly below to slightly above average at reporting time.</td>
</tr>
<tr>
<td>Watch</td>
<td>Conditions are not far from average but there is a potential risk to final production. There is still time and possibility for the crop to recover to average conditions if the ground situation improves. This label is only used during the planting-early vegetative and the vegetative-reproductive stages.</td>
</tr>
<tr>
<td>Poor</td>
<td>Crop conditions are well below average. Crop yields are likely to be 10-25% below average. This is used when crops are stunted and are not likely to recover, and impact on production is likely.</td>
</tr>
<tr>
<td>Failure</td>
<td>Crop conditions are extremely poor. Crop yields are likely to be 25% or more below average.</td>
</tr>
</tbody>
</table>