The GEO Global Agricultural Monitoring (GEOGLAM) Initiative

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GEOGLAM

• Launched by G-20 in 2011 (French Presidency), under the Action Plan on Food Price Volatility and Agriculture and re-affirmed in 2016

• Vision: Provision of actionable, science-driven, open, information at sub-national to global scales, that guides policies, investments and decisions in food security, crop productivity and agricultural markets
  – Through use of coordinated, multi-sensor, Earth Observations (EO)
  – Recognizing the need for more reliable, open, transparent information on agriculture

www.geoglam.org
GEOGLAM: an International Collaborative Initiative

- Based on common interests, leveraging domestic and international research and development activities
- Strengthening existing national and international agricultural monitoring systems
- Foundation in user-driven operational R&D
  - Emphasis on identifying information needs and transitioning research to operations - building capacity for sustained monitoring
- The Initiative is being Implemented through Contributory Projects – you can join in

Governance Structure
- Advisory Committee (co-chaired by US and China)
- Secretariat at GEO Secretariat (located w. WMO) in Geneva
- Distributed implementation Team with Project Leads
GEOGLAM Terminology

• Earth Observations (EO)
  – Satellite and in-situ data (e.g. from meteorological ground stations)
  – Timely information products and model output
  – Data > products and services > reliable Information
  – Validated i.e. of known accuracy

• The GEOGLAM Community of Practice
  – Data Providers, Researchers, Operational Agencies for Agricultural Monitoring (e.g. Ministries of Agriculture, Hydromet and Ag Statistics) and Many Others
  – Providing decision support for markets and policies

• From Research to Operations
  – Moving robust research methods into the operational domain
  – Challenging for all countries
  – Issue of capacity, resources and institutional roles and sustainability
The GEOGLAM Community
Open Community made up of international and national agencies concerned with agricultural monitoring including Ministries of Ag, Space agencies, Universities, & Industry

Can we identify some partners from South and Southeast Asia
Strengthened Monitoring Systems
National • Regional • Global

Research-to-Operations
Capacity Development for EO

Operational R&D
Method Development & Improvement

EO Data Coordination
Acquisition Access Continuity

Science-Based Information
Decision • Policy • Action

Outlook for Markets & Trade
National & International Food Policy
Agricultural Subsidies
Farm Advisory & Extension
Sustainable Development Goals

Vulnerability & Impact Assessments
Support to Food Aid Organizations
Insurance & Investments

Public Space Sector
Commercial Space Sector
Ag Meteo & Climate Services

In-situ & Crowd-sourcing

Food Production
Early Warning

Food Production
Market Information

Food Security
Sustainable Development

Climate Change

Sustainable Development Goals
What does GEOGLAM Provide?

• A platform for multi-lateral and bilateral cooperation
  – coordination on provision and use of Earth Observations for agricultural monitoring
  – forum for exchange of experience, tools, methods → best practices

• R&D in support of operational systems

• Translating EO data into policy relevant information
  – Bridging the gap between EO-science & the Economics / Policy communities

• Articulating and advocating community observation requirements and information needs to EO data providers
Free & Open Access to EO data, information, tools is a critical component

More access = more users
More users = better methods
Better methods + good data = improved quality of information

Improved quality of information supports better decision making and mitigates food insecurity.

Restrictive data policies are missed opportunities.
Long-term Continuity & Access to Earth Observation data

- Free and open data policy*
Need for Timely Information on:

- Cropland Area
- Crop Calendars, Crop Rotation
- Area Planted
- Crop Type (within season)
- Crop Condition (within season)
- Crop Yield Estimates (within season)
- Crop Production Assessments (within season)

- Agricultural Land Use Change
  - Intensification, Increase or loss of agricultural land, Changing cropping systems, Land abandonment, Aquaculture
GEOGLAM Crop Monitor for AMIS: a core project

- Partnering with the Agricultural Market Information System
- Objective: transparent, timely, crop condition assessments in primary agricultural production areas
- Reflecting an international consensus, building on existing systems
- 4 Crops: Wheat, Maize, Soybean, Rice
- Focus: main production/export countries (G20)

www.geoglam-cropmonitor.org
Countries Covered by the Crop Monitors

about 94% of world agricultural area...
Output Crop Condition Maps Covering AMIS Crops

Conditions as of September 28th 2016

Quick and easy to interpret crop conditions oriented for econ and policy communities

Crops that are in other than favorable conditions are displayed on the map with their crop symbol & driver.
Rice conditions for Southeast Asia have generally improved and are favourable, most notably in India, Indonesia, and the Philippines. However, there is some concern over heavy rainfall in northern Viet Nam and over flash flooding and delayed start of the season in Thailand. Conditions remain mixed for China.
• Successful collaboration between two G20 initiatives
• Bridging the gap between the EO and Econ communities
• First time the international community comes together to produce operational assessments
# AMIS - GEOGLAM Crop Calendar

Selected leading producers:

## Wheat

<table>
<thead>
<tr>
<th>Country</th>
<th>JFMAMJJASOND</th>
<th>JFMAMJJASOND</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU (21%)*</td>
<td>winter</td>
<td>Harvest</td>
</tr>
<tr>
<td>China (17%)</td>
<td>spring</td>
<td>Harvest</td>
</tr>
<tr>
<td>India (13%)</td>
<td>winter</td>
<td>Planting</td>
</tr>
<tr>
<td>US (8%)</td>
<td>spring</td>
<td>Harvest</td>
</tr>
<tr>
<td>Russia (8%)</td>
<td>winter</td>
<td>Harvest</td>
</tr>
</tbody>
</table>

## Maize

<table>
<thead>
<tr>
<th>Country</th>
<th>JFMAMJJAASOND</th>
<th>JFMAMJJAASOND</th>
</tr>
</thead>
<tbody>
<tr>
<td>US (35%)</td>
<td>north</td>
<td>Harvest</td>
</tr>
<tr>
<td>China (22%)</td>
<td>south</td>
<td>Harvest</td>
</tr>
<tr>
<td>Brazil (8%)</td>
<td>1st crop</td>
<td>Harvest</td>
</tr>
<tr>
<td></td>
<td>2nd crop</td>
<td></td>
</tr>
<tr>
<td>EU (7%)</td>
<td></td>
<td>Harvest</td>
</tr>
<tr>
<td>Argentina (3%)</td>
<td>Harvest</td>
<td></td>
</tr>
</tbody>
</table>

## Soybeans

<table>
<thead>
<tr>
<th>Country</th>
<th>JFMAMJJAASOND</th>
<th>JFMAMJJAASOND</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA (31%)</td>
<td>Planting</td>
<td>c c c Harvest</td>
</tr>
<tr>
<td>Brazil (29%)</td>
<td>c c Harvest</td>
<td>Planting c</td>
</tr>
<tr>
<td>Argentina (18%)</td>
<td>c c Harvest</td>
<td>Planting</td>
</tr>
<tr>
<td>China (4%)</td>
<td>Planting</td>
<td>c c c Harvest</td>
</tr>
<tr>
<td>India (3%)</td>
<td>Planting</td>
<td>c c c Harvest</td>
</tr>
</tbody>
</table>

## Rice

<table>
<thead>
<tr>
<th>Country</th>
<th>JFMAMJJAASOND</th>
<th>JFMAMJJAASOND</th>
</tr>
</thead>
<tbody>
<tr>
<td>China (29%)</td>
<td>intermediary crop</td>
<td>Planting</td>
</tr>
<tr>
<td></td>
<td>late crop</td>
<td>Planting c</td>
</tr>
<tr>
<td></td>
<td>early crop</td>
<td>Planting</td>
</tr>
<tr>
<td>India (21%)</td>
<td>kharif</td>
<td>Planting</td>
</tr>
<tr>
<td></td>
<td>rabi</td>
<td>Planting</td>
</tr>
<tr>
<td>Indonesia (9%)</td>
<td>main Java</td>
<td>c c c Harvest</td>
</tr>
<tr>
<td></td>
<td>second Java</td>
<td>Planting</td>
</tr>
<tr>
<td>Viet Nam (6%)</td>
<td>winter-spring</td>
<td>c c c Harvest</td>
</tr>
<tr>
<td></td>
<td>summer/autumn</td>
<td>Planting</td>
</tr>
<tr>
<td></td>
<td>winter</td>
<td>Planting</td>
</tr>
<tr>
<td>Thailand (4%)</td>
<td>main season</td>
<td>c c c Harvest</td>
</tr>
<tr>
<td></td>
<td>second season</td>
<td>c c c Harvest</td>
</tr>
</tbody>
</table>

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

- **Planting (peak)**
- **Harvest (peak)**
- **Planting**
- **Harvest**
- **Growing period**

Weather conditions in this period are critical for yields.
Asia Rice Crop Mask

Looking for improved crop masks and calendars
Crop Conditions in May 2016 showing devastating effects of southern Africa drought that left millions in need of humanitarian assistance.

The GEOGLAM Early Warning Crop Monitor

Focused on countries most vulnerable to food insecurity
GEOGLAM Early Warning Crop Monitor
Monthly Reporting Since February 2016

Suggestion from South Africa to develop a regionally focused crop monitor for Sub-Saharan Africa—currently under discussion with regional partners.
Initiation of National Crop Monitors: Tanzania Example
Decades of earth observation research has led to the development of innovative agricultural monitoring capabilities that are, or close to being operational:

- Crop type, area and condition.
- Snow cover, Soil moisture, Excessive wetness, Drought.
- Climate and weather related impacts on production.
- Crop yield forecasting.
- Harvest progress monitoring.
- Soil management (tillage, crop residue).
- Biomass production.
- Crop damage, disease and pests.
- Soil health.
Annual Crop Inventory

- Based on RADARSAT-2 and optical imagery.
- Maps every farm field in Canada at ≥ 80% accuracy.
- Consistently one of the top data sets downloaded from data.gc.ca.
- Used for programs and policy and a broad range of OGD, Provincial and sector uses...
  (eg. Next slide)
Asia-RiCE: Vietnam
Rice monitoring using Sentinel-1A data

Monitoring of Winter-Spring rice

The Mekong Delta, Vietnam
300 km x 300 km
20 m resolution

04-04-2015

100 km x 70 km, 20 m resolution

04-04-2015

Rice: early stage
Rice: tillering stage
Rice: reproductive stage
Rice: maturity stage
Non rice (forest, other LULC)
Water (ocean, river, aquaculture)
Land outside the Vietnam Mekong delta
National Level Crop Area Estimation (USA)

Soy Example Using Multi-Resolution Data

- A Sample based approach
- 70 sample blocks, in 3 strata, to estimate in season soybean cultivated area

- Satellite based estimate: 351,317 km² (SE 24,915)
- USDA NASS 2015 soybean estimate: 334,000 km²

Hansen et al. 2014
New Sentinel 2-based Products aligned with the GEOGLAM core products

- Binary map identifying annually cultivated land at 10m, updated every month.
- Crop type map at 10m for the main regional crops, including irrigated/rainfed discrimination.
- Vegetation status map at 20m delivered every 10 days (NDVI, LAI, pheno index).
- Monthly cloud-free surface reflectance composite at 10-20m.

Defourny et al
New products from Sentinel 2 Agri (Including national 10 m crop type)

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Stat</th>
<th>%</th>
<th>Stat</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>312.6</td>
<td>15.9</td>
<td>132.8</td>
<td>25.3</td>
</tr>
<tr>
<td>Winter wheat</td>
<td>262.4</td>
<td>33.2</td>
<td>331.8</td>
<td>45.0</td>
</tr>
</tbody>
</table>

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<tbody>
<tr>
<td>Maize</td>
<td>314.9</td>
<td>15.9</td>
<td>166.4</td>
<td>25.3</td>
</tr>
<tr>
<td>Winter wheat</td>
<td>204.5</td>
<td>33.2</td>
<td>481.0</td>
<td>45.0</td>
</tr>
</tbody>
</table>

Land cover map, 2016 (SRI)

- Artificial
- Winter wheat
- Winter rapeseed
- Spring crops (wheat, barley)
- Maize
- Sugar beet
- Sunflower
- Soybeans
- Other cereals
- Forest
- Grassland
- Bare land
- Water
- Wetland
- Winter barley
- Peas

Main crops, 2016 (Sentinel-2 Agri)

- No crop/No data
- Maize
- Soybeans
- Winter wheat
- Spring barley
- Sunflower
- Other crops
Research Foci at the Joint Experiment for Crop Assessment and Monitoring (JECAM) Sites
(JECAM co leads: Ian Jarvis (Canada), Pierre Defourny (Belgium))

Developing and Comparing Methods for:
- Crop Type mapping
- Crop Condition monitoring
- Yield Estimation modeling
- Soil Moisture estimation
- Residue and Tillage monitoring etc.
- JECAM field data collection and validation protocols and intercomparisons

JECAM.org
Cảm ơn