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GEOGLAM Global Agricultural Monitoring

GEOGLAM international cooperation activities

Chris Justice

Center for Global Agricultural Monitoring and Research

Dept. of Geographical Sciences

University of Maryland

GEO: an International Coordinating Framework

using Earth Observations for societal benefit

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GEOGLAM Global Agricultural Monitoring

GEOGLAM: A GEO Agriculture Initiative

- Aim: Strengthen the international community's capacity to produce and disseminate relevant information on agricultural production at national, regional and global scales, through Earth Observations
- Approach: Building on existing monitoring systems – strengthening international and national capacity
- Emphasis on: Producer countries (G20+), Countries-at-Risk & National Capacity Building (demand driven)
- Vision: ....the use of coordinated and sustained EO to inform decisions and actions in agriculture

http://www.earthobservations.org/geoglam.php

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GEOGLAM Global Agricultural Monitoring

GEOGLAM is implemented through 6 Components

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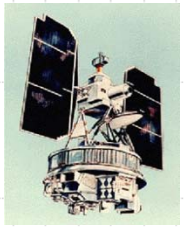
GEOGLAM
Global Agricultural Monitoring

Context For GEOGLAM

Monthly Wheat Prices 1960-2011($/Metric Ton)

Source: World Bank



Landsat 1 Launched (1972)

1971/2's price hike

CROP INVENTORY EXPERIMENT LARGE AREA

LACIE

NASA NOAA USDA

1996 price hike

2010/11 Price hikes
Drought:
Russia USA

2008 Price hikes
Droughts:
Australia & Ukraine

GEO Ag Task

400.00
350.00
300.00
250.00
200.00
150.00
100.00

1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010


International recognition of critical need for improved real time, reliable, open information on global agricultural production prospects
Critical for agricultural policies, stabilizing markets, averting food crises
Need to increase food production by 50%-70% by 2050 to meet demands
The Washington
China View
WORLD
Food crisis grip rural parts of Nepali Chitwan district
Climate change compounds Ethiopia's food crisis
Huge Gap Predicted In Supply
Drought is key factor in Kenya's food crisis
More than 1 billion hungry, UN
15 October 2009
The Great Food Crisis of 2011
Kenya among food crisis nations, U
FAMINE
Why are Ethiopians starving again? What should the world do—and not do?
The New York Times
Food Crisis
NEWS AFRICA
Somalia famine: UN warns of 750,000 deaths
Rush to Use Crops as Fuel Raises Food Prices and Hunger Fears
Hunger in India: The Crisis Wors
The New York Times
Thursday, November 10, 2011
2010 Pakistan Floods
Bloomberg.com
Global Food Crisis
The new world of soaring food prices
Little Keeps Nigeria From Crisis
BBC NEWS
ONE-MINUTE WORLD NEWS
Bangladesh bans most rice expo
Bangladesh has banned exports of nearly all the rice it produces to prevent shortages and keep food costs down.
The government said the ban began on Tuesday and will last six months.
TIME
IN PARTNERSHIP WITH CNN
The World's Growing Food
By VIVIENNE WALT
U.N. Food Agency Issues Warning on China Drought
Food security for 7 billi
REUTERS

Policy Framework for GEOGLAM

G20 Final Declaration

44. We commit to improve market information and transparency in order to make international markets for agricultural commodities more effective. To that end, we launched:

- The "Agricultural Market Information System" (AMIS) in Rome on September 15, 2011, to improve information on markets ...;

- The **"Global Agricultural Geo-monitoring Initiative" (GEO-GLAM)** in Geneva on September 22-23, 2011. This initiative will coordinate satellite monitoring observation systems in different regions of the world in order to enhance crop production projections and weather forecasting data.

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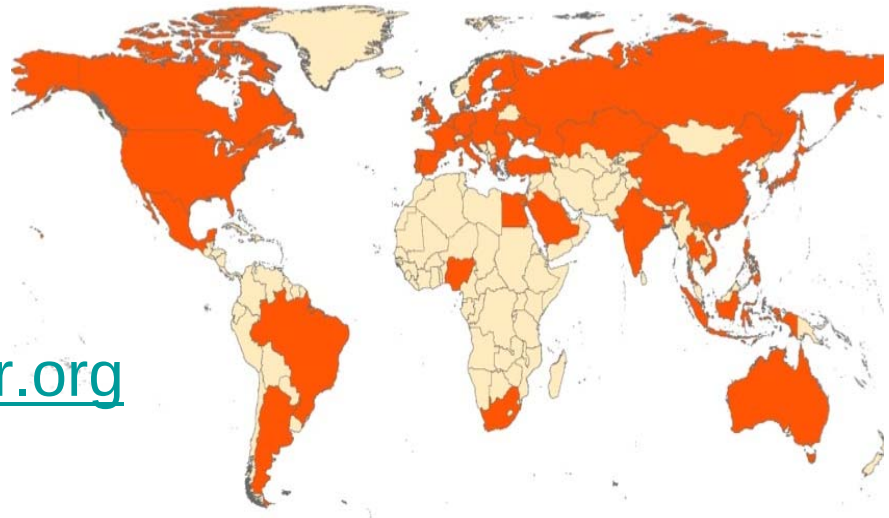
GEOGLAM Global Agricultural Monitoring

GEOGLAM Crop Monitor for AMIS

- Objective: transparent, timely, crop condition assessments in primary agricultural production areas
  - highlighting potential hotspots of stress or bumper crop
- Focus: stabilizing/calming markets - context of price volatility
- Response to G-20 AMIS request for an international consensus on crop conditions, building on existing systems
- 4 crops: Wheat, maize, soybean, rice
- AMIS Countries account for 90% of global production of the 4 crops
- End Users: AMIS Community



http://www.geoglam-crop-monitor.org

Coordination by the University of Maryland
on behalf of the GEO Secretariat – with NASA Applied Sciences support

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GEOGLAM Crop Monitor Partners

> 35 Partners and Growing

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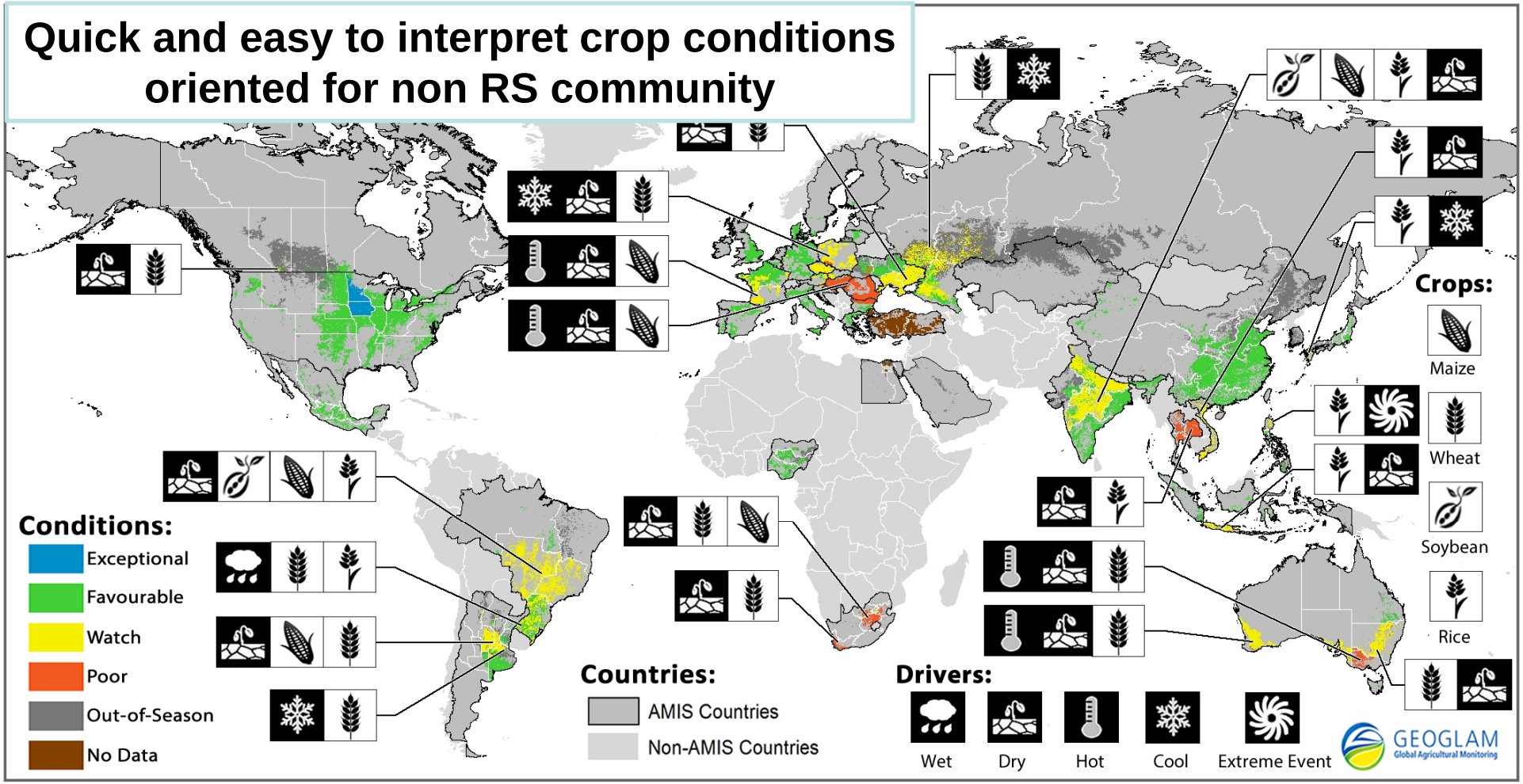
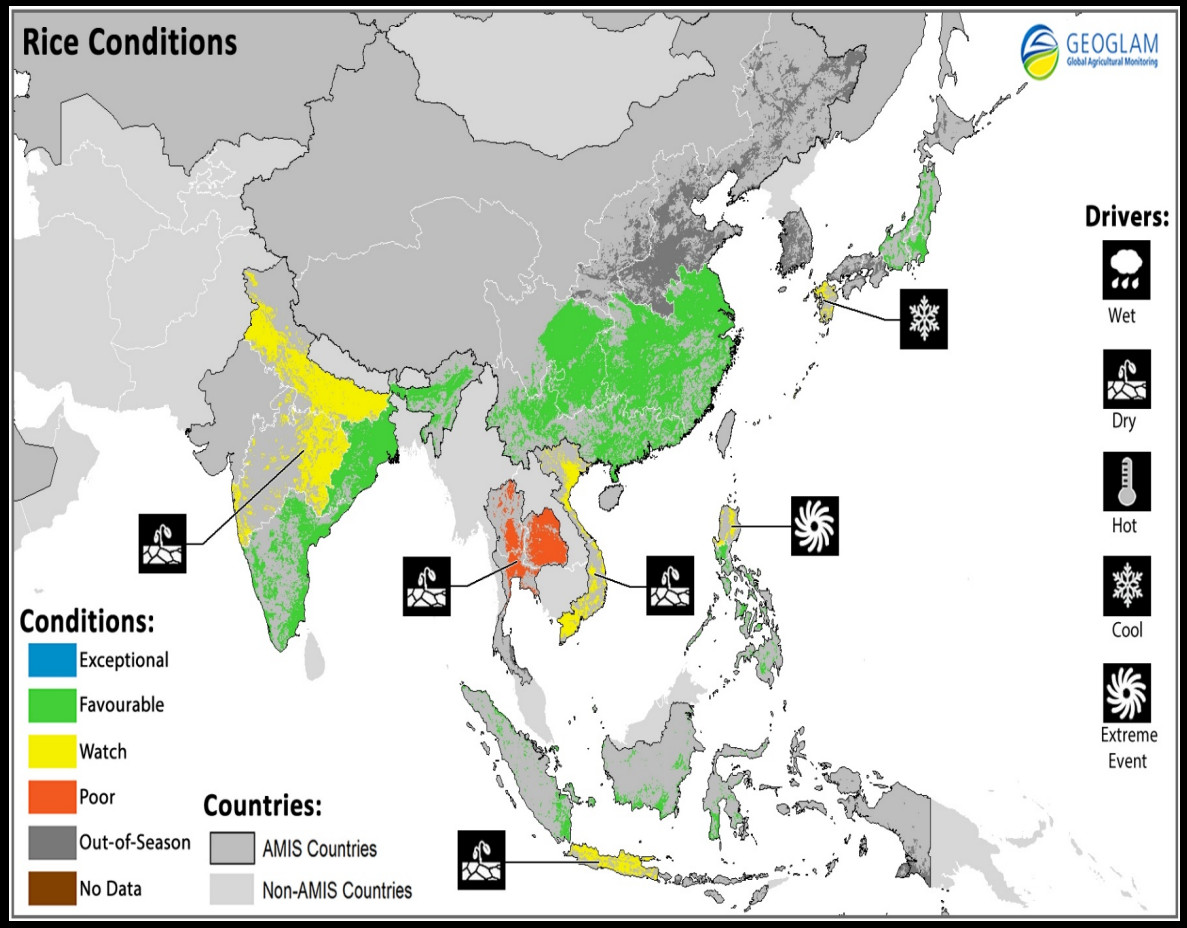
Condition Synthesis Maps Covering All AMIS Crops

Crop Conditions & Drivers as of October 28, 2015



Crops that are in other than favorable conditions are displayed with their crop symbol & driver.
Separate maps are also provided for each crop.

Asia Rice Crop Conditions as of October 28th



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GEOGLAM Global Agricultural Monitoring

Operational Monthly Bulletin since 2013 Published in the AMIS Market Monitor

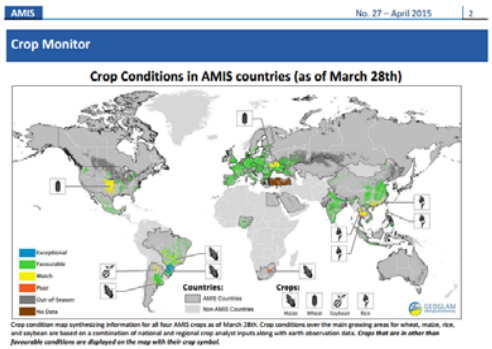
AMIS

Market Monitor

No.27 – April 2015 www.amis-outlook.org

*The **Market Monitor** is a product of the Agricultural Market Information System (AMIS). It covers the international markets for wheat, maize, rice and soybeans, giving a synopsis of major market developments and the policy and other market drivers behind them. The analysis is a collective assessment of the market situation and outlook by the ten international organizations that form the AMIS Secretariat. Ultimately, the report aims at improving market transparency and detecting emerging problems that might warrant the attention of policy makers.*

Contents



AMIS No. 27 – April 2015 2

Crop Monitor

Crop Conditions in AMIS countries (as of March 28th)

Countries: AMIS Countries, Non-AMIS Countries

Crops: Maize, Wheat, Soybean, Rice

Crop condition map synthesizing information for all four AMIS crops as of March 28th. Crop conditions over the main growing areas for wheat, maize, rice, and soybean are based on a combination of national and regional crop analyst inputs along with earth observation data. *Crops that are in other than favourable conditions are displayed on the map with their crop symbol.*

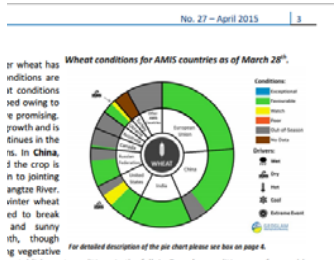
Highlights

Wheat- In the northern hemisphere winter wheat has mostly resumed vegetative growth and conditions are generally favourable. In the EU, conditions are generally good. In the US there is still concern due to dry conditions in the Southern Plains. In China, conditions are favourable and in the Russian Federation and Ukraine, conditions remain mostly favourable though some concern remains over dry establishment conditions in the autumn. In Canada and India, conditions are mostly favourable.

Maize- In the southern hemisphere, conditions are generally favourable. In Brazil conditions have improved and are favourable overall for the two maize crops. In Argentina conditions are favourable. In South Africa, below-normal yields are expected for both white and yellow maize. In the northern hemisphere, conditions are favourable for the newly planted crops in China and Mexico, as well as in India where harvest is almost complete.

Rice- Conditions are overall still favourable. In China, conditions are favourable for the early rice though there is concern for the single cropped rice in the south west due to excessive moisture. In Thailand, dry season rice conditions are poor due to water deficiency and planted area is significantly down. In India, Viet-Nam, Indonesia, Nigeria and Brazil, overall conditions are favourable. In the Philippines, dry season rice conditions have deteriorated and yields are expected to be slightly down relative to last year.

Soybeans- In the southern hemisphere, conditions remain favourable. In Brazil, despite earlier concerns over dryness, conditions are favourable and harvest is in progress. In Argentina, conditions remain mostly favourable except for a few areas in the north that suffered water excess.



No. 27 – April 2015 3

Wheat conditions for AMIS countries as of March 28th.

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

Drivers: Wet, Dry, Hot, Cool, Extreme Event

For detailed description of the pie chart please see box on page 4.

ir wheat has
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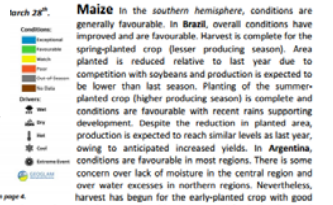
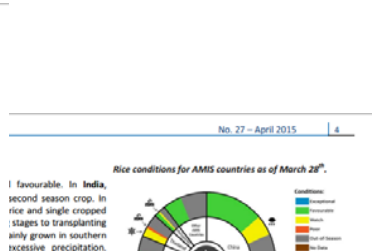
the crop is
n to jointing
angtze River.
inter wheat
ed to break
and sunny
th, though
g vegetative

establishment conditions in the fall. In **Canada**, conditions are favourable
ere the majority of winter wheat is planted, experienced warmer than
owfall, which may lead to some winter-kill. The amount of winter wheat
wer than expected, largely due to a late harvest. Eastern Canada has
es and below normal snowfall, which may also result in some winter-kill
nditions are mostly favourable except in the northern regions where there
stress. In **Ukraine**, winter wheat has resumed vegetative growth, and
ncern remains over the unfavourable autumn establishment conditions,
nd are better than last year particularly in southern regions, which is the



For detailed description of the pie chart please see box on page 4.

Maize In the *southern hemisphere*, conditions are generally favourable. In **Brazil**, overall conditions have improved and are favourable. Harvest is complete for the spring-planted crop (lesser producing season). Area planted is reduced relative to last year due to competition with soybeans and production is expected to be lower than last season. Planting of the summer-planted crop (higher producing season) is complete and conditions are favourable with recent rains supporting development. Despite the reduction in planted area, production is expected to reach similar levels as last year, owing to anticipated increased yields. In **Argentina**, conditions are favourable in most regions. There is some concern over lack of moisture in the central region and over water excesses in northern regions. Nevertheless, harvest has begun for the early-planted crop with good prospects. In **South Africa**, despite recent widespread rains, below-normal yields are expected for both white and yellow maize as result of hot and dry conditions during the first half of February. In the *northern hemisphere*, conditions are favourable. In **China**, conditions are favourable for spring-planted maize. In **Mexico**, favourable crop conditions continue throughout the country owing to good weather conditions and sufficient rainfall. Harvest of the spring-summer cycle is complete with good prospects. Sowing for the autumn-winter cycle has begun and planted area has increased in the northwest region. In **India**, harvest is almost complete and conditions are favourable.



No. 27 – April 2015 4

Rice conditions for AMIS countries as of March 28th.

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

Drivers: Wet, Dry, Hot, Cool, Extreme Event

For detailed description of the pie chart please see box below.

favourable. In **India**,
second season crop. In
rice and single cropped
stages to transplanting
ainly grown in southern
excessive precipitation.
in the south west, are
rice conditions are poor
ea is significantly down
regions there is also
r in the season that led
nditions are favourable.
complete and area is
nditions continue to be
g to favourable sunlight

The crop is in vegetative to maturity stages. Planted area is down relative to last the rainy season. In **Brazil**, harvest is in progress and conditions are favourable. ed for with an increase in yields and therefore production is expected to be similar season rice conditions have deteriorated and yields are expected to be slightly combination of factors including heat, dry conditions, wind damage and pests. **Nigeria**, conditions are favourable for irrigated rice.

Soybeans In the *southern hemisphere*, conditions are favourable. In **Brazil**, conditions are favourable and harvest is in progress. Despite earlier concerns over lack of rain in part of the Southeast, Midwest and Northeast, overall productivity is expected to increase relative to last year. Accounting for the increase in planted area, national production may be significantly higher than last year. In **Argentina**, conditions remain mostly favourable. The first crop is in grain filling to maturity stages, and the second crop is flowering or filling grains. The northern areas suffered water excess, but the impacts have not been evaluated yet.

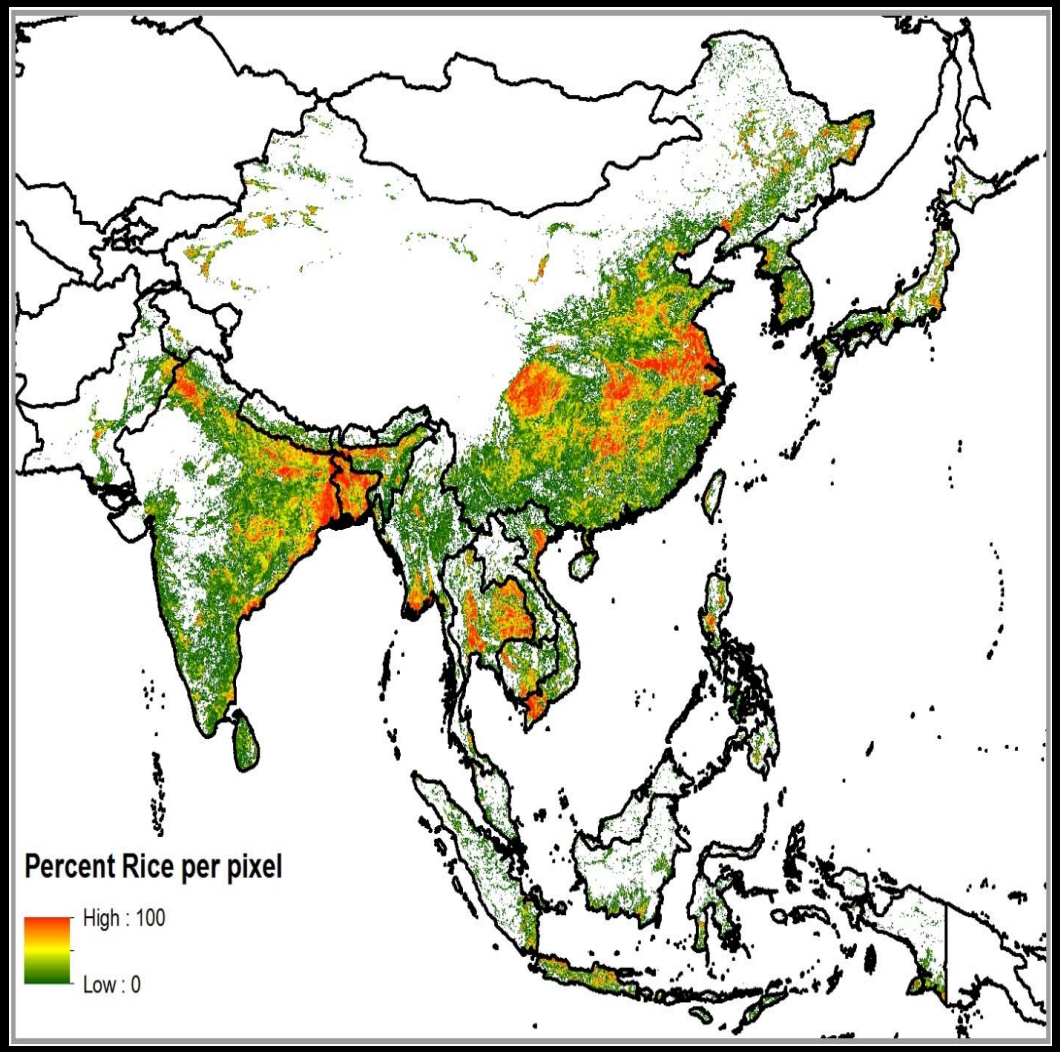
presents a country's share of total AMIS production (5-year average). Main producing production) are shown individually, with the remaining 10 percent grouped into the "Other thin each slice is divided between crops in-season (colour) and out-of-season (gray). The in- o the various crop conditions within that country. When conditions are labelled as 'poor' or information on the key climatic drivers affecting conditions. The coloured areas reflect national production.

ument is conducted by GEOGLAM with inputs from the following partners (in alphabetical order): Argentina (INTA), Asia Rice Countries (APSIS, ASEAN+3 & Asia RICE), Australia (ABARES & CSIRO), Brazil (CONAB & INPE), Canada (AAFC), China (CAS), EU (EC JRC MARS), Indonesia (LAPAN & MOA), International (CIMMYT, FAO, IFPRI & IRRI), Japan (JAXA), Mexico (SIAP), Russia (IKI), South Africa (ARC & GeoTerraImage & SANSA), Thailand (GISTDA & OAE), Ukraine (NASU-NSAU & UHMC), USA (NASA, UMD, USGS – FEWS NET, USDA (FAS, NASS)), Viet nam (VAST & VRHM-HAMO). The findings and conclusions in this joint multi-agency report are consensual statements from the GEOGLAM experts, and do not necessarily reflect those of the individual agencies represented by these experts. Map data sources: Major crop type areas based on the IFPRI/NASA SPAM 2005 beta release (2010), USDA/NASS 2013 CDL, 2013 AAFC Annual Crop Inventory Map, GLAM/UMD, GLAD/UMD, Australian Land Use and Management Classification (Version 7), SIAP, ARC, and JRC. Crop calendars based on GEOGLAM partner crop calendars and USDA/FAO crop calendars.

More detailed information on the GEOGLAM crop assessments is available at www.geoglam-crop-monitor.org.

For more information regarding the new crop monitor and pie charts: http://geoglam-crop-monitor.org/pages/about.php?targetmaps-charts

Asia Rice Crop Mask: a work in progresss



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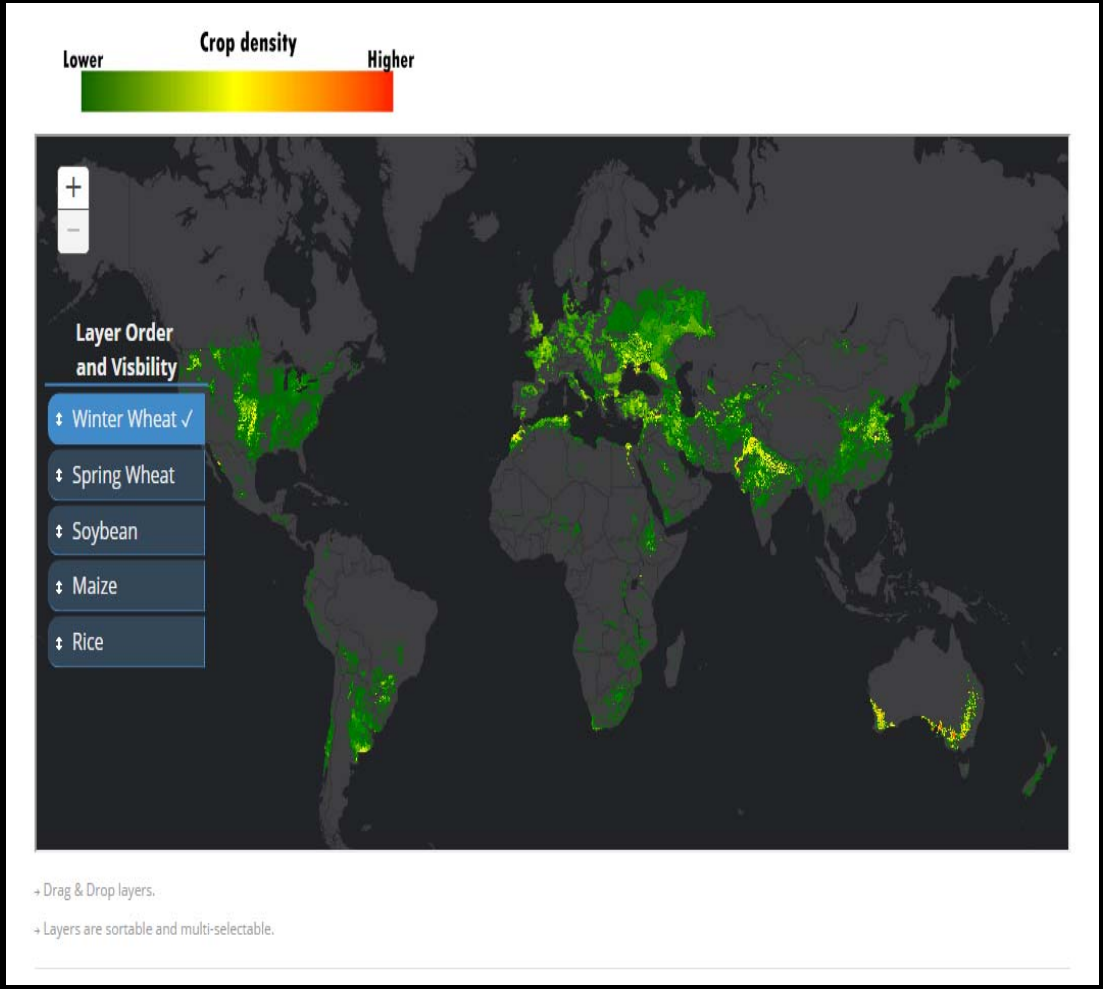
Crop Mask Viewer



Currently available at: http://cropmonitor.org/pages/data-crop-masks.php

Crop Calendar Viewer

Also, currently available at: http://cropmonitor.org/pages/data-crop-calendars.php

GEOGLAM is seeking greater involvement of countries from S and SE Asia in the Crop Monitor - providing up to date information on rice-crop distribution, crop calendars and monthly crop condition

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Asia-RiCE

GEOGLAM Asia-RiCE

- Regional Coordination Example -

Shin-ichi Sobue

GEOGLAM Lead of AsiaRiCE

Remote Sensing Technology Center of Japan / JAXA

Sobue.shinichi@jaxa.jp

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Scope of Asia-RiCE

- Agencies in Asia launched Asia-RiCE (Asia Rice Crop Estimation & Monitoring) program as support to GEOGLAM component 1.
- Asian countries = approx. 90% of world rice production & consumption.
  - Rice is not just a food, but closely related to culture.

ID	Target Agricultural Products
P1	**Rice Crop Area Estimates/Maps**
P2	**Crop Calendars/Crop Growth Status**
P3	**Crop Damage Assessment**
P4	**Agro-meteorological Information Products**
P5	**Production Estimation and Forecasting**

http://www.asia-rice.org

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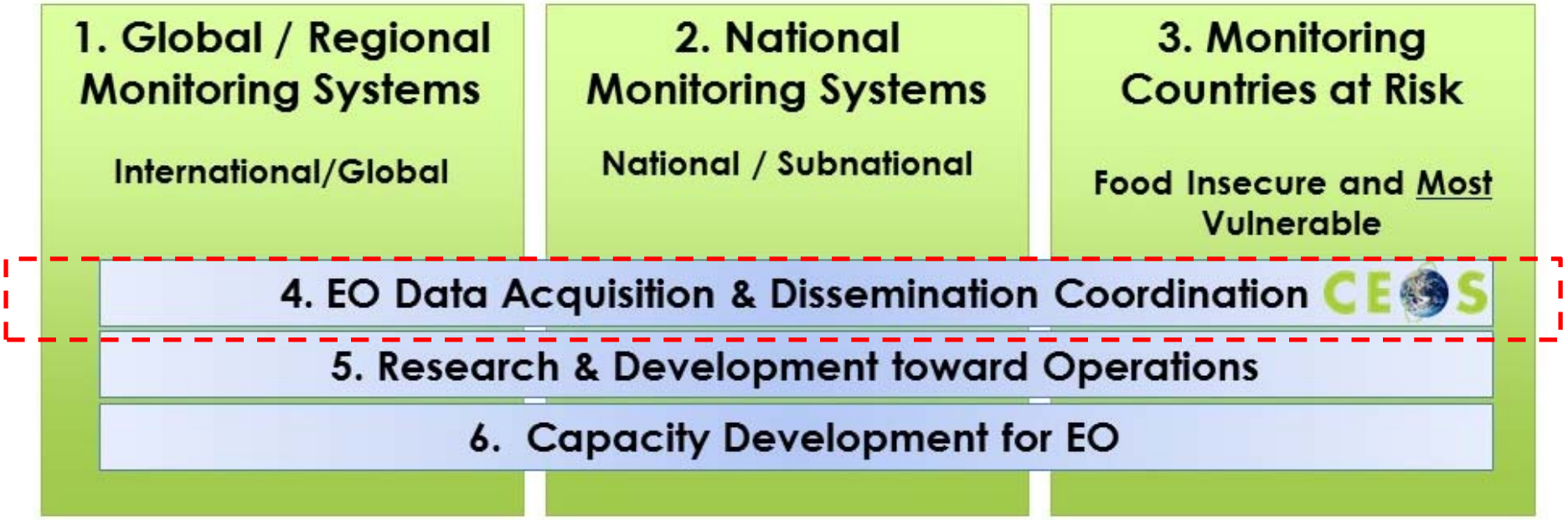
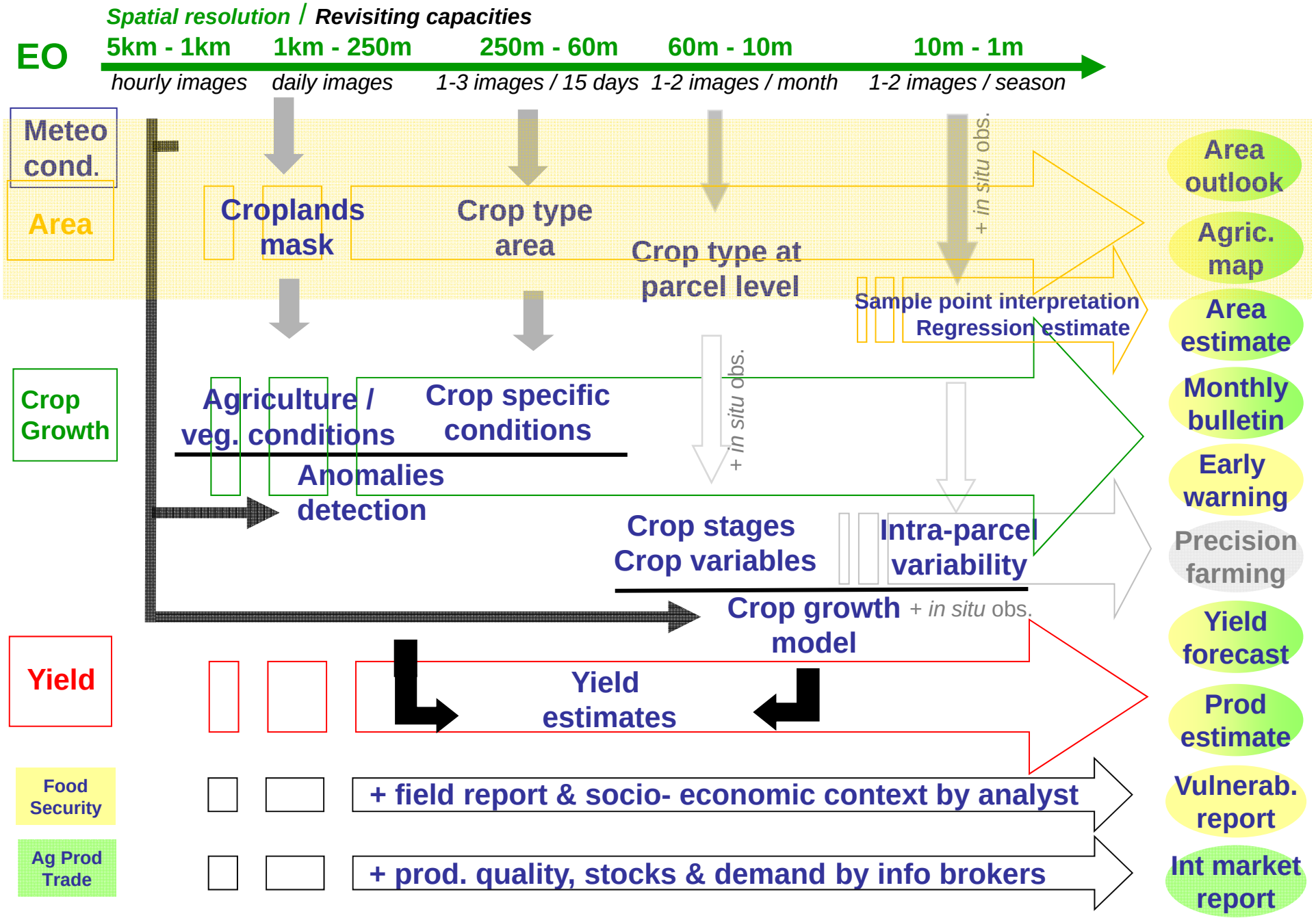
Research and Development towards Operational use



Agricultural Monitoring : EO data and Final products



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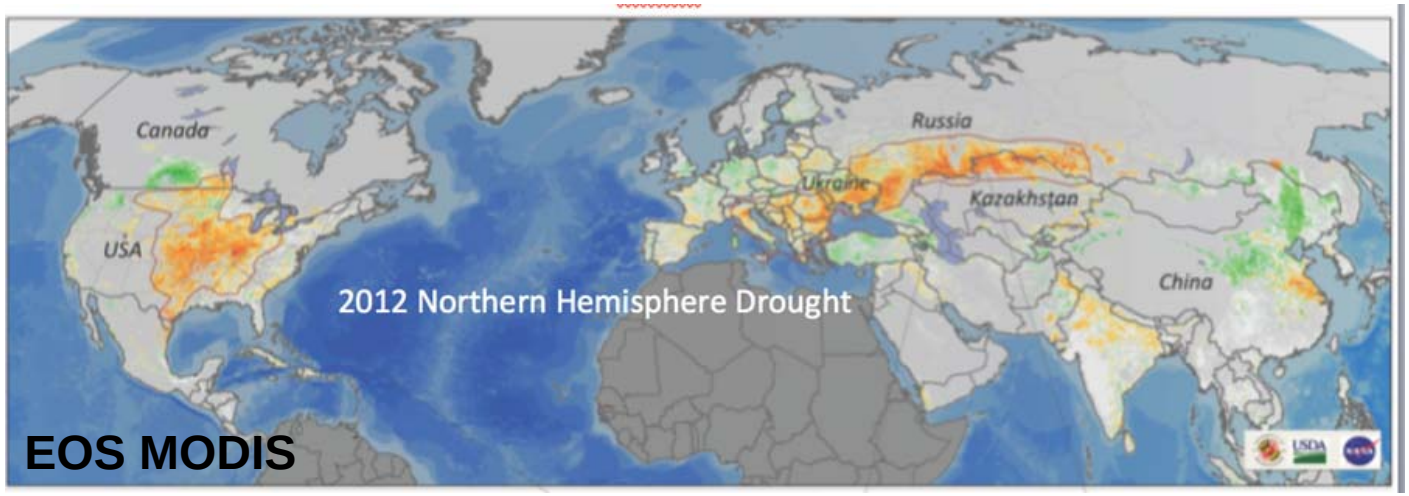
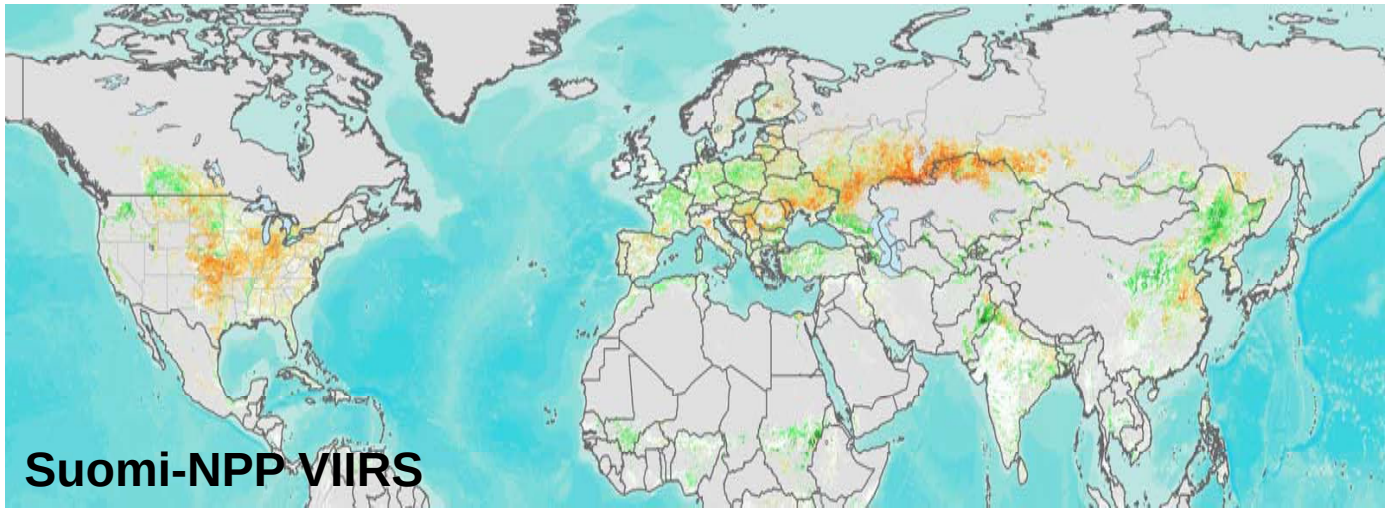
Coarse Resolution Anomaly Product Continuity





July 30 2012

EOS MODIS

↓

Suomi-NPP

↓

JPSS VIIRS

Vermote (GSFC)

NASA

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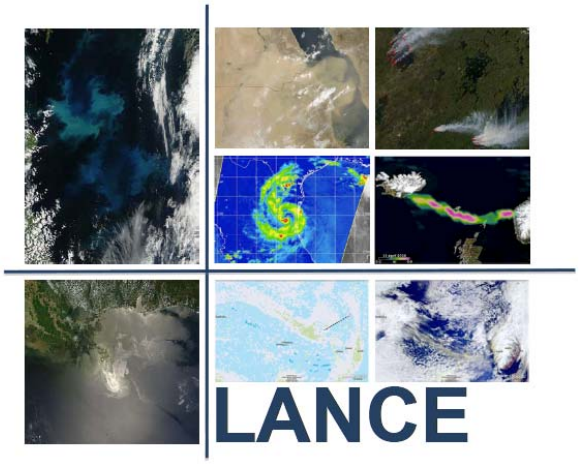
Requirement for Near Real Time Data for Agricultural Monitoring

National Aeronautics and Space Administration



LANCE

AIRS AMSR-E MLS MODIS OMI

Near-real-time data for applications, disaster response and field campaigns

- ✓ Products within 3 hours of observation
- ✓ Highly available processing and distribution systems
- ✓ Products based on science algorithms

lance.nasa.gov

Land Atmosphere Near-real-time Capability for EOS

Timely data are critical for crop monitoring!

NASA EOS near-real-time daily observations are processed and provided < 3 hours from observation

Steps underway for S-NPP VIIRS LANCE in early 2106

Sentinel contribution to JECAM & GEOGLAM
Primary missions for all targets Products

Req#	Spatial Resolution	Spectral Range	Effective observ. frequency (cloud free)*	Sample Type	Field Size	Target Products: Crop Mask	Crop Type Area and Growing Calendar	Crop Condition Indicators	Crop Yield	Crop Biophysical Variables	Environ. Variables	Ag Practices / Cropping Systems
	Coarse Resolution Sampling (>100m)											
1	500 - 2000 m	thermal IR + optical	Daily	Wall-to-Wall	All			X	L			
2	100-500 m	optical + SWIR	2 to 5 per week	Cropland Extent	All	X	X	X	L	L		L
3	5-50 km	microwave	Daily	Cropland Extent	All			X	X	X	X	
	Moderate Resolution Sampling (10 to 100m)											
4	10-70m	optical + SWIR + TIR	Monthly (min 2 out of season + 3 in season). Required every 1-3 years.	Cropland Extent	All	X	L/M					X
5	10-70m	optical + SWIR + TIR	Weekly (min. 1 per 16 days)	Sample	All	X	X	X	X	X	X	X
6	10-100m	SAR	Weekly (min. 1 per 2 weeks)	Cropland Extent of persistant cloudy areas/Rice	All	X	X	X	X	X	X	X

Sentinel-3

SMOS

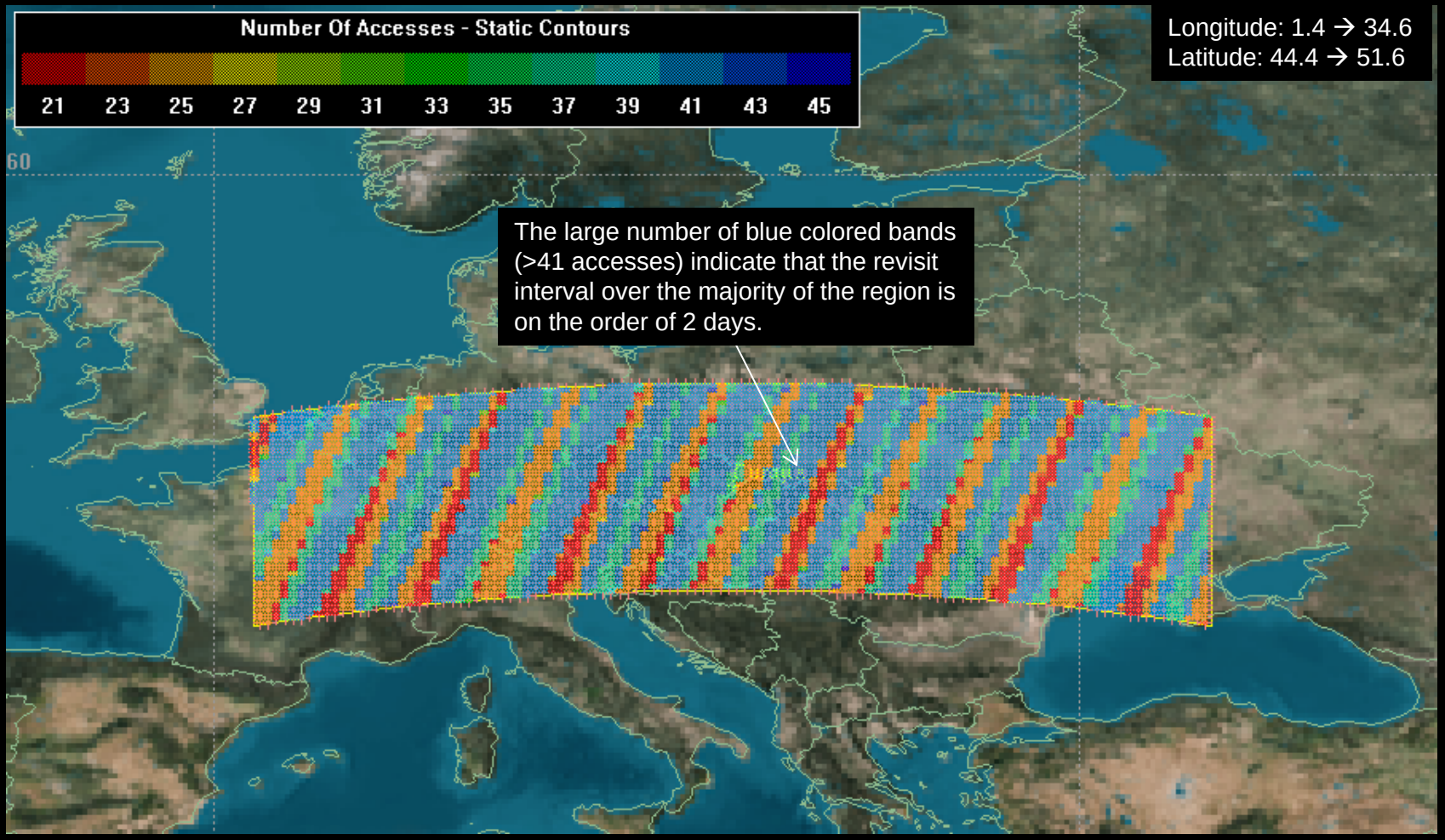
Sentinel-2

Sentinel-2

Sentinel-1

Source: CEOS ACQUISITION STRATEGY FOR GEOGLAM PHASE 1

Sentinel-2A and 2B and LDCM



The picture shows the number of times LDCM and the Sentinel 2 satellites accessed areas on the ground over an 80 day period of time.

- 21 accesses indicates a maximum revisit interval of ~3 days 19 hours
- 46 accesses indicates a minimum revisit interval of ~1 day 18 hours

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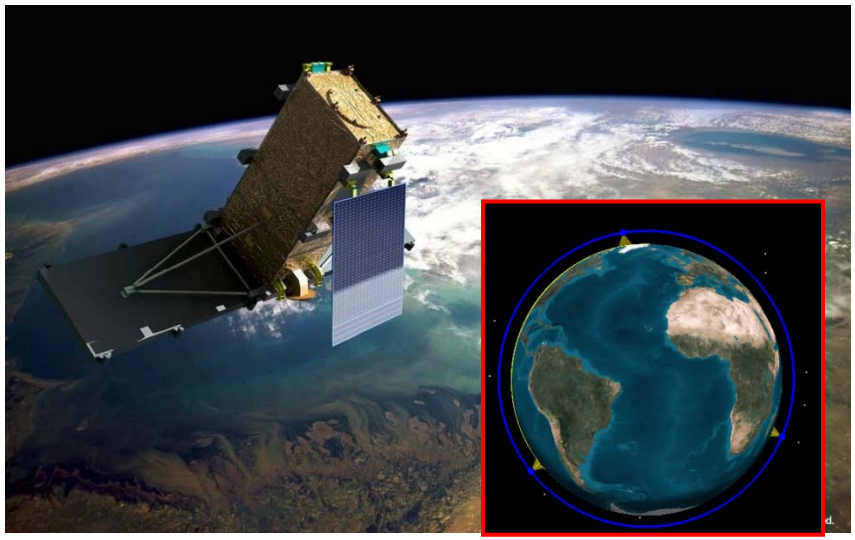
Global Agricultural Monitoring

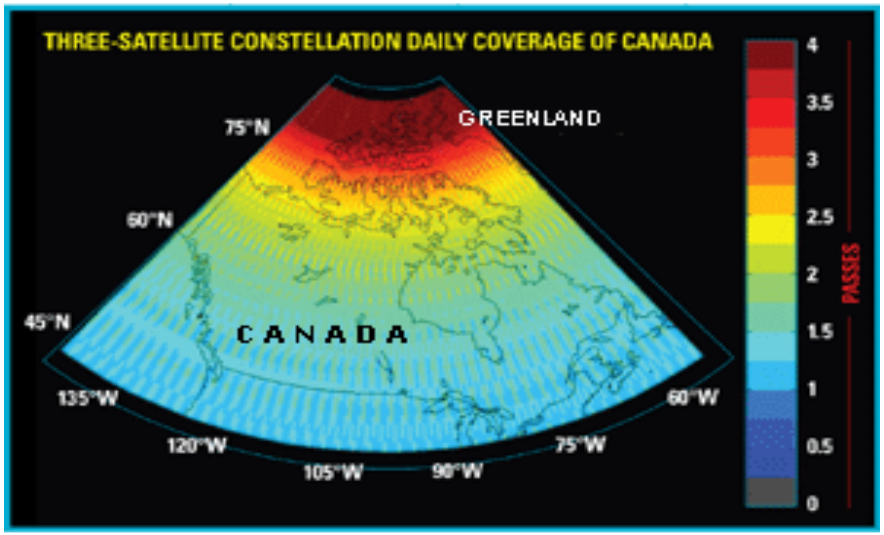
Small Sat optical systems for studying land use

RADARSAT Constellation Mission

http://www.asc-csa.gc.ca/eng/satellites/radarsat/default.asp

- Evolution of the RADARSAT Program →3 satellites – 600 km orbit, 32 minutes separation
- 15 min/orbit imaging (avg) x 3 satellites
- Average daily global access; 4-day exact repeat
- Focus on Marine Surveillance, Disaster Management and Ecosystem Monitoring (*including Agriculture*)





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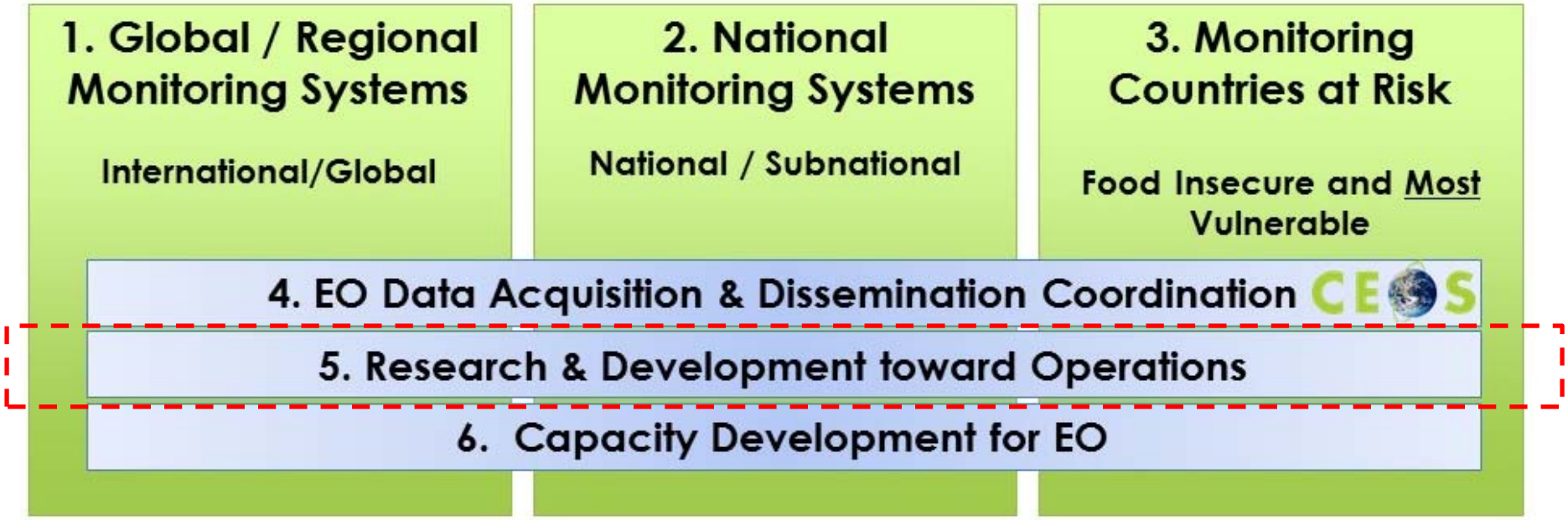
GEOGLAM Global Agricultural Monitoring

Research and Development towards Operational use



JECAM
Joint Experiment for Crop Assessment and Monitoring

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Global network of over 30 voluntary JECAM sites

A collaborative global network of sites, working on common research questions (*crop type, area, condition, yield*) and representing very diverse agro-ecosystems

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Areas of GEOGLAM R and D

- Improved global EO-based products – cropland, cropping systems, crop type, crop calendars
- New international Earth Observations for agriculture – soil moisture, ET, biomass
- Quantitative EO-based indices related to crop production
- Improved methods and tools for crop production assessment and forecasting (national / sub-national)
- Development of Standards & Best Practices
- Economic impact of improved forecasts
- Global monitoring of agricultural land use change
- Crop model and EO integration

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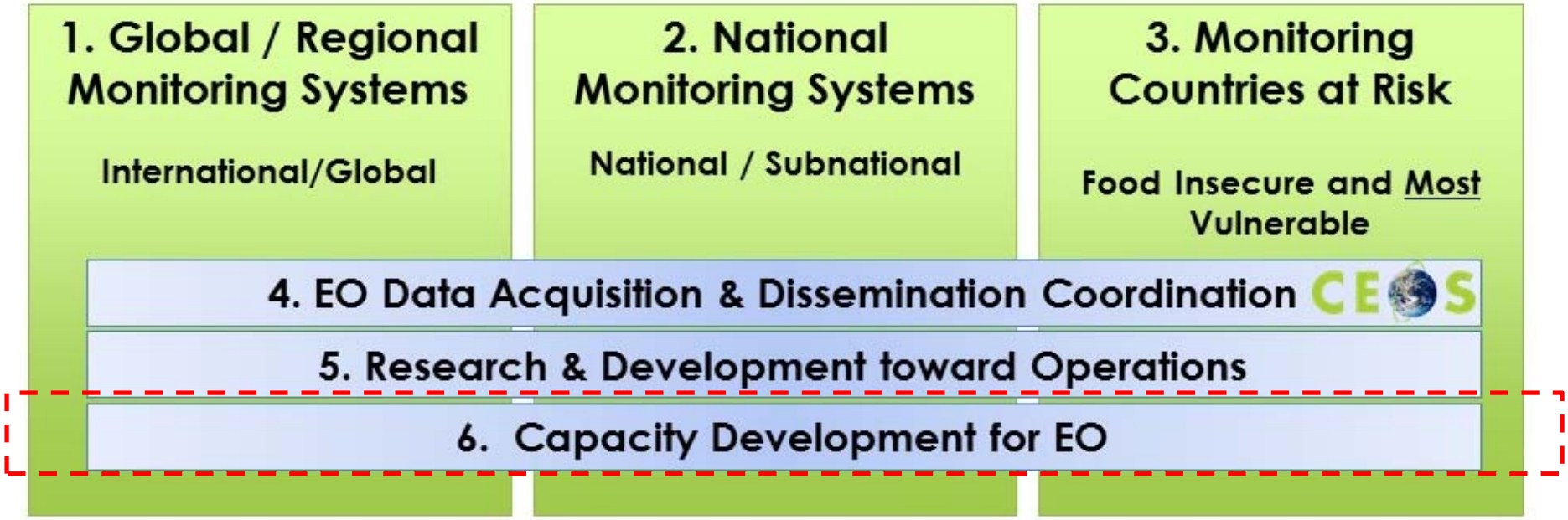
Research and Development towards Operational use

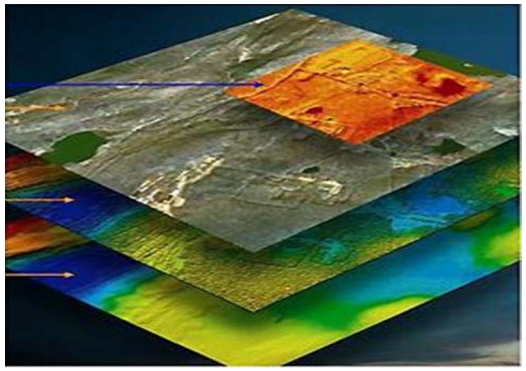


GEOGLAM CAPACITY DEVELOPMENT COMPONENT

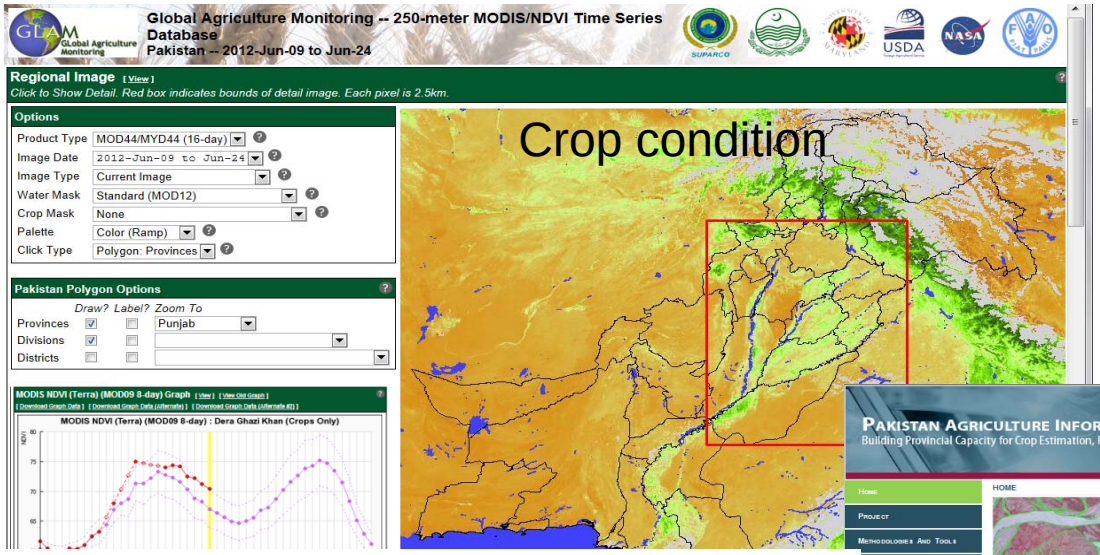
Reinforce National/Regional/Global capacities to conduct agricultural monitoring

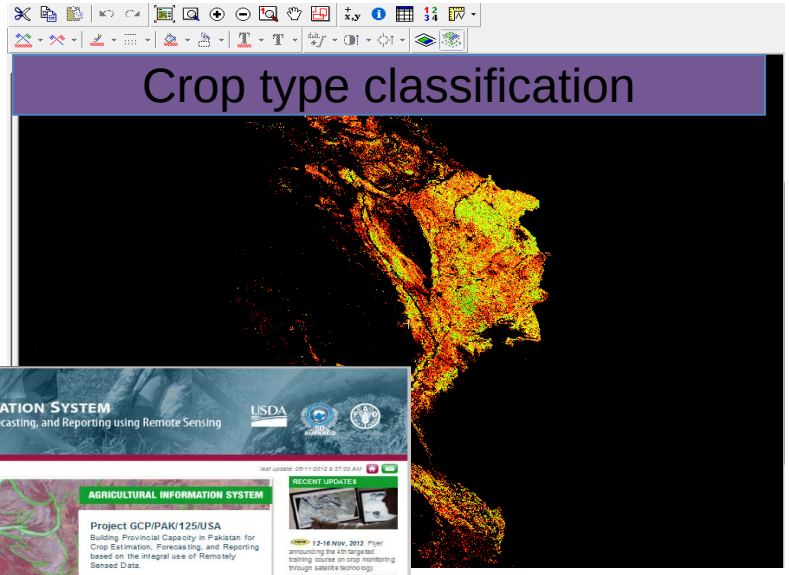
MAIN STEPS

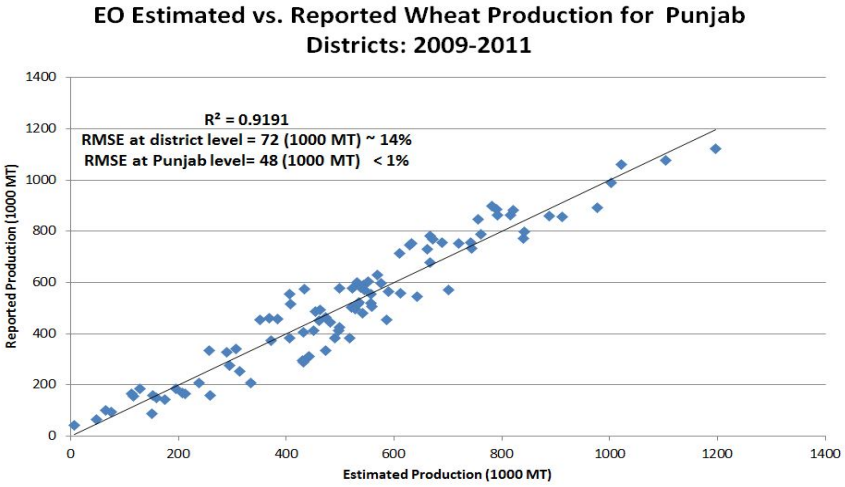
- Assess national capacity in agriculture monitoring and EO data use;
- Define data coverage requirements;
- Define activities that can assist national implementation;
- Develop customised training at national level;
- Conduct a series of regional workshops;
- Regional training / information exchange and continued global/regional networking



Pakistan Agricultural Information System
(Collaboration between USDA, FAO, SUPARCO, CRS, & UMD)







National Capacity Building Pakistan (USDA/FAO/UMD)

1038 full-time crop reporters continuously inspect agricultural fields in 1240 villages in Punjab Province.

Modernizing Crop Reporting Systems

- Collect data digitally in 1240 villages of Punjab.
- Use GPS-enabled cell phones, location-aware software.
- Automatic upload data to central spatial database.

GROUP ON EARTH OBSERVATIONS

GEOGLAM Global Agricultural Monitoring

So in summary what is GEOGLAM doing?

- Increasing communication and sharing experience amongst the Ag Monitoring Community of Practice & with related programs
- Promoting EO-based approaches for operational agricultural monitoring
- Method testing & inter-comparison, developing best practices
- R and D to develop new monitoring capabilities & products
- Translating EO data into policy relevant information
- Articulating and advocating community requirements to EO data providers
- Helping improve national and international agricultural monitoring systems