

**"Open Session on "Space for Agriculture and Food Security"**

Rome, 09 March 2012

World Food Program Auditorium



**Crop Monitoring and Food Security:  
the JRC action and prospect**

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FAO - ESA

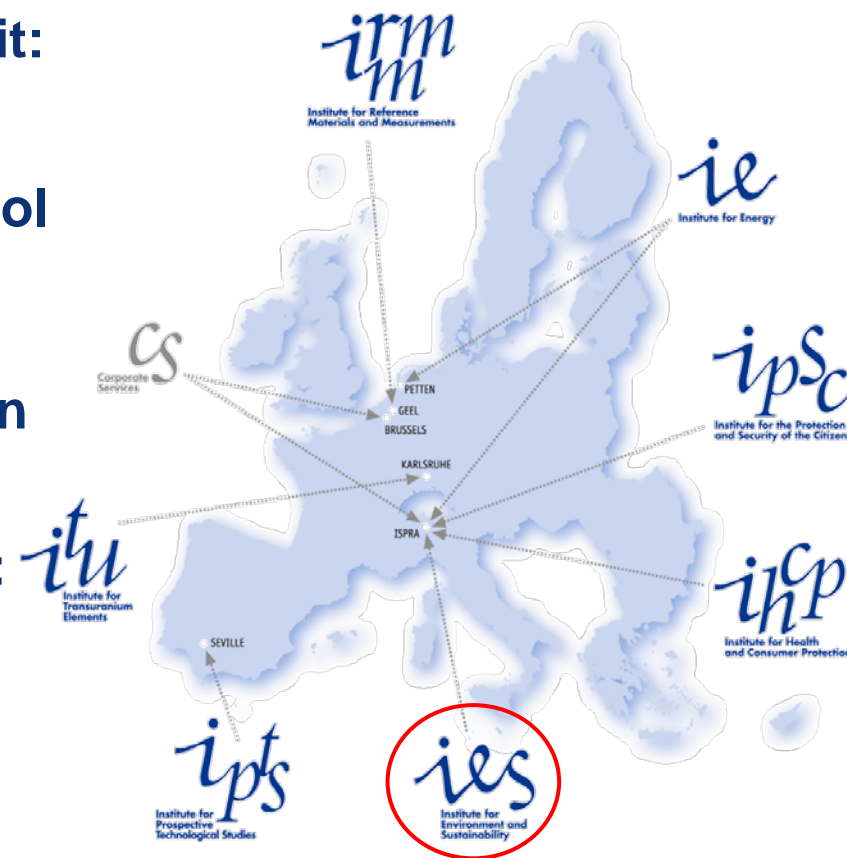
[thierry.negre@ec.europa.eu](mailto:thierry.negre@ec.europa.eu); [thierry.negre@fao.org](mailto:thierry.negre@fao.org)

<http://www.jrc.ec.europa.eu/>

**JRC : The European Commission's in-house science service**

**MARS (Monitoring Agricultural ResourceS) Unit:**  
60 staff in 4 actions:

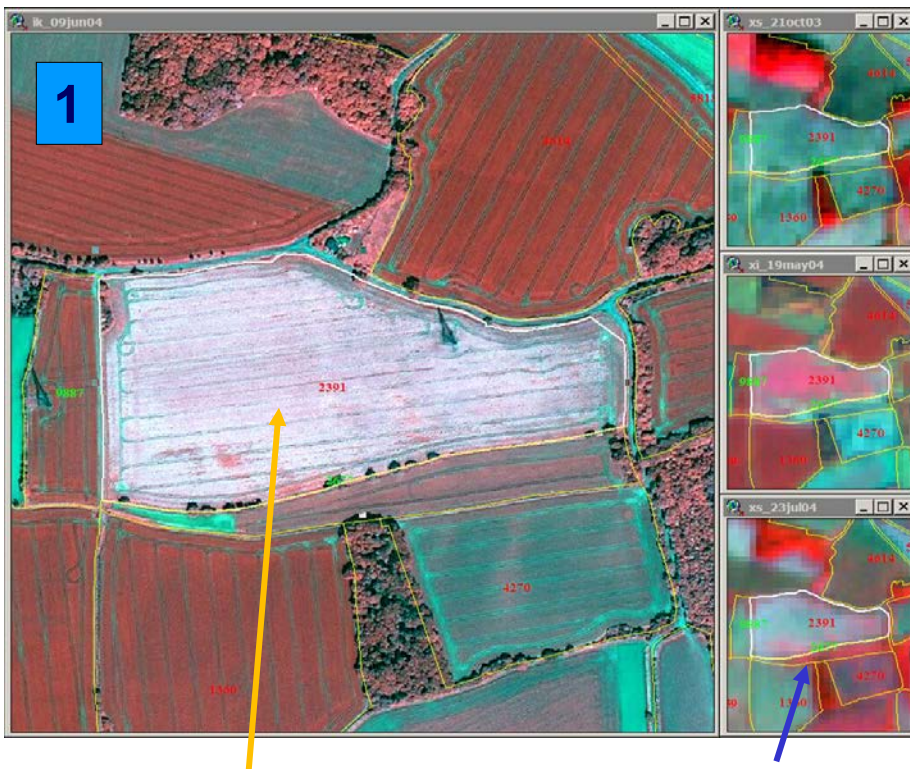
- **GEOCAP**: Geomatics for the CAPcontrol
- **CID**: Community Image Data portal
- **AGRI4CAST**: crop production forecast in Europe; extension under development
- **FOODSEC (Food Security Assessment)**: crop monitoring & food security information mainly in sub-Saharan Africa



2 types of methods (choice of MS) based on Computer-Aided Photo Interp.

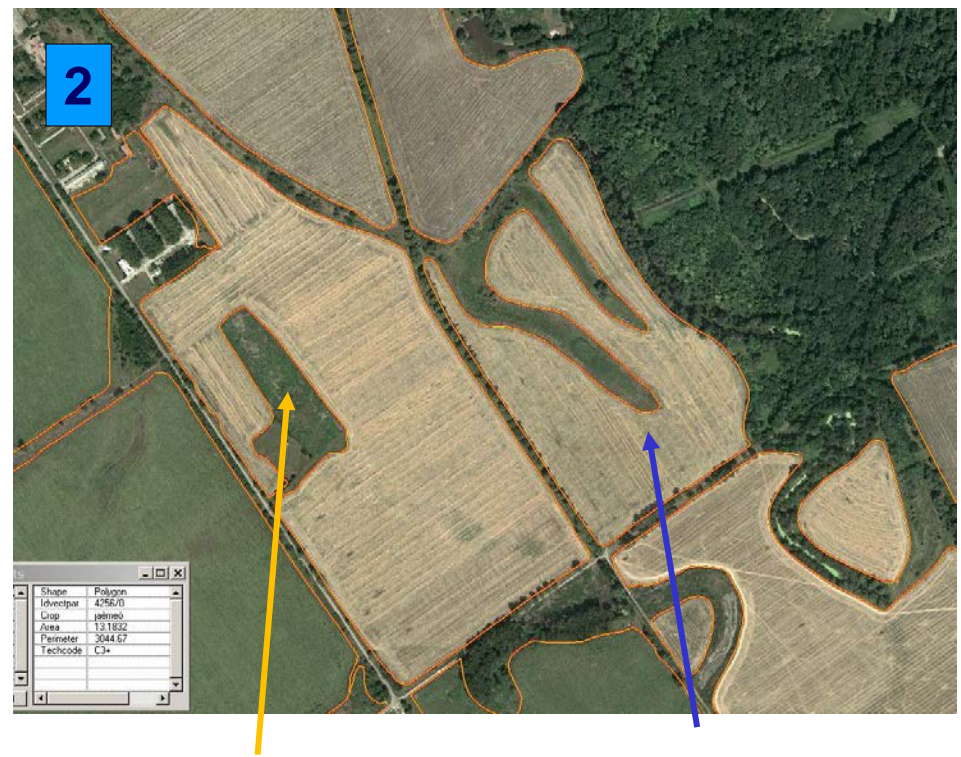
[1] “standard” scenario: VHR+HR: 1 VHR image + n current year HR images

[2] “VHR only” scenario: 1 VHR + rapid field visits



Control of area  
with VHR image

Control of crop  
with 3 HR dates



Other use easily  
detected on imagery

Measurement time of this  
parcel (3 km perimeter) on  
image < time with GPS



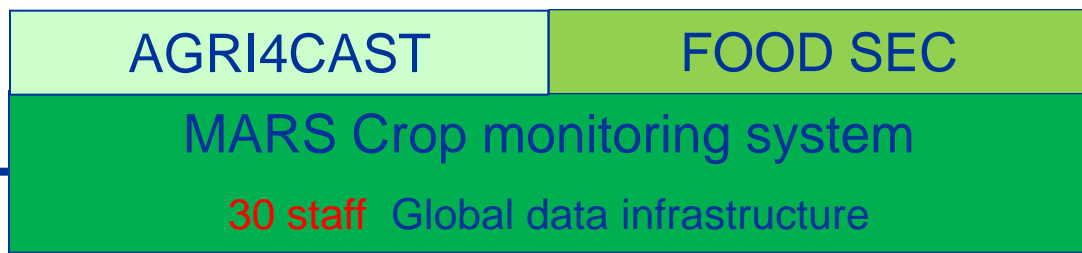
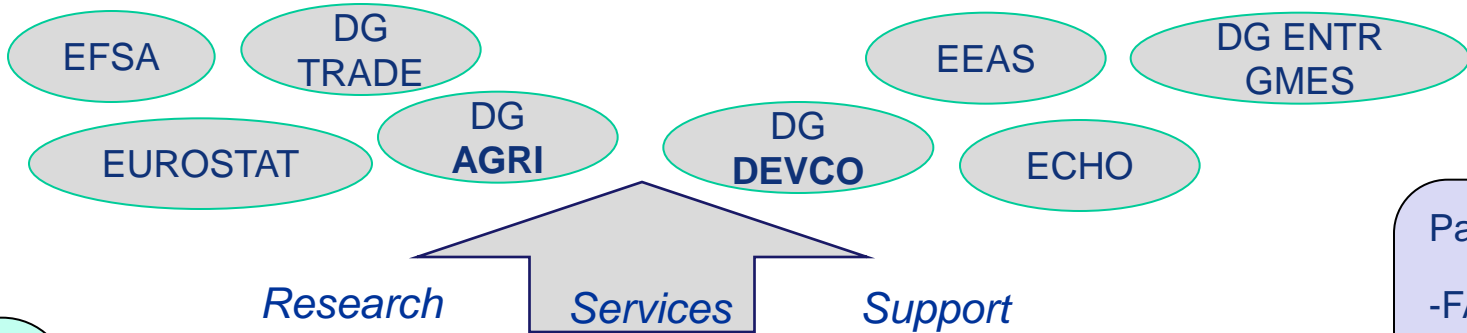


**Images VHR (1m)**

**Reference year  
VS  
Current year**

**Control by CAPI**

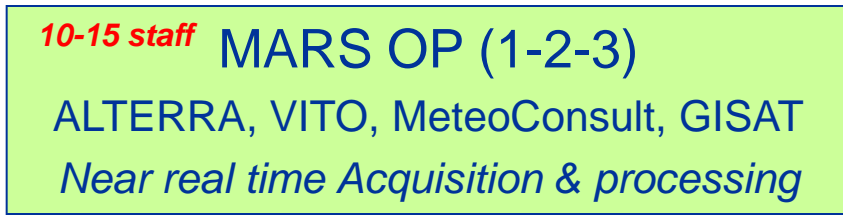
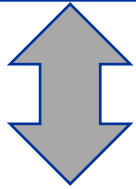
**Example of GAEC control: maintenance of landscape element  
(hedge, pond, isolated trees, trees in line or group of trees)**



- Crop monitoring
- Yield forecast
- Crop area estimation
- Climate change impact
- Early warning

- Partners:
- FAO, WFP
  - USAID, FEWSNET
- Collaboration agreements:
- USA, Brasil, Argentina, China, Kazakhstan, African Union, Agrhymet, RCMRD...

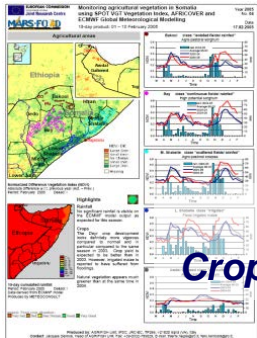
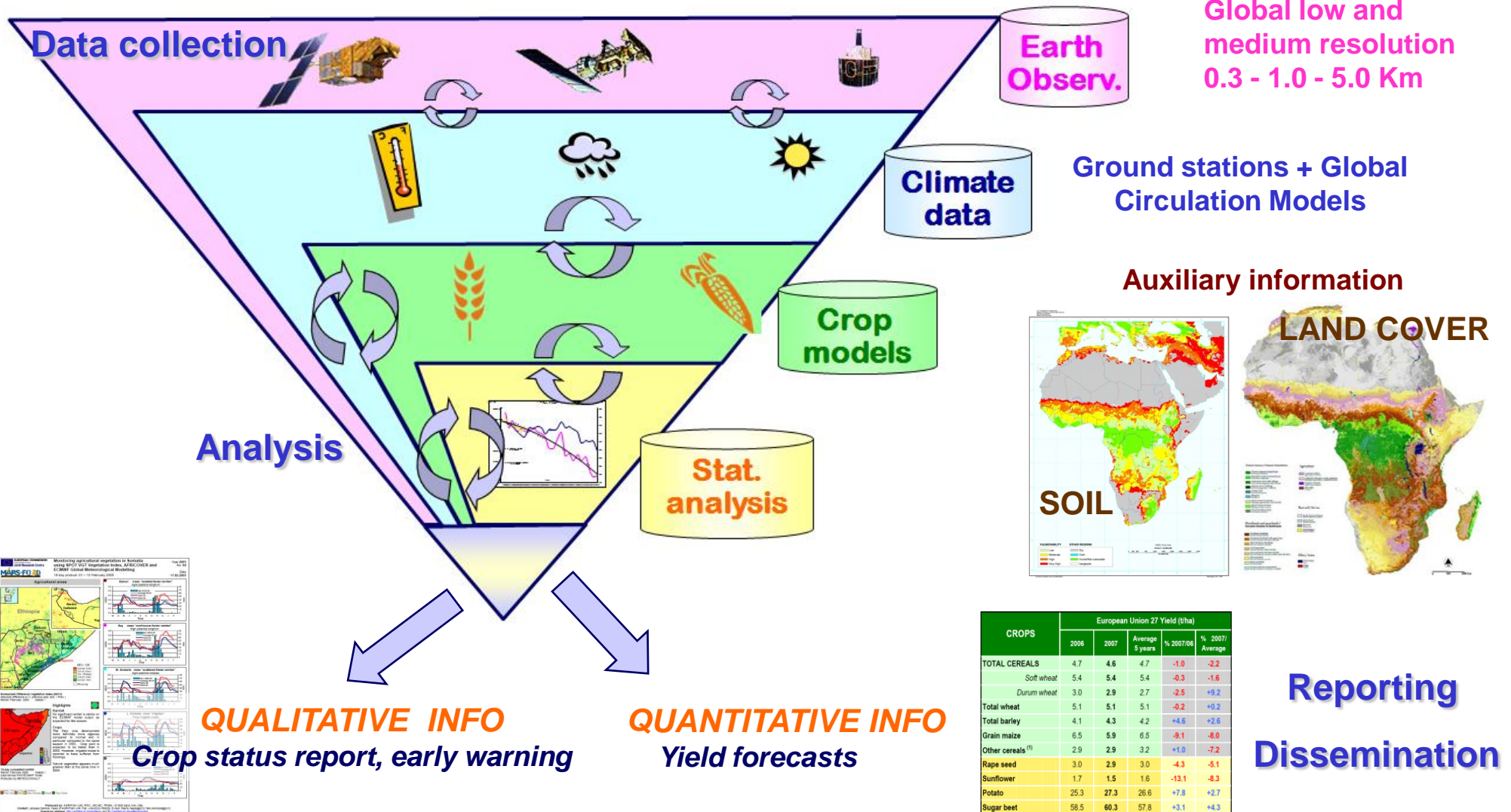
*1.5 M€ / an*



GEO  
Community of  
Practice



## MARS Crop Growth Monitoring and Yield forecasting System



CROPS	European Union 27 Yield (t/ha)				
	2006	2007	Average 5 years	% 2007/06	% 2007/Average
<b>TOTAL CEREALS</b>	4.7	4.6	4.7	-1.0	-2.2
Soft wheat	5.4	5.4	5.4	-0.3	-1.6
Durum wheat	3.0	2.9	2.7	-2.5	+9.2
Total wheat	5.1	5.1	5.1	-0.2	+0.2
Total barley	4.1	4.3	4.2	+4.6	+2.6
Grain maize	6.5	5.9	6.5	-9.1	-8.0
Other cereals <sup>(1)</sup>	2.9	2.9	3.2	+1.0	-7.2
Rape seed	3.0	2.9	3.0	-4.3	-5.1
Sunflower	1.7	1.5	1.6	-13.1	-8.3
Potato	25.3	27.3	26.6	+7.8	+2.7
Sugar beet	58.5	60.3	57.8	+3.1	+4.3



Meteo data interpolated or model outputs (CGMS)

**Contents**

- I. Agrometeor overview
- II. Crop monitoring (data maps & remote sensing)
- III. Crop yield forecast (EU27)
- IV. Analysis country-by-country (EU27)
- V. Yield forecast in EU27 neighbourhood

**Highlight**

Western Europe experienced two prevailing events — warm temperatures in April leading to a large CO2C growing degree days surplus and accelerating crop development and a pronounced dry spell from March onwards leading to critical soil moisture values in the United Kingdom, the Benelux countries, France, Germany and northern Italy. Rainfall is now urgently needed to avoid any further reduction of yield potential. By contrast, the Mediterranean countries received beneficial rainfall during this period and the temperatures were quite favourable, especially in March. Winter crop yields look promising at this stage. The countries around the Black Sea reported a rather cold period and, in general, a water surplus. Crop development is normal or slightly delayed and soil moisture conditions are good throughout these countries.

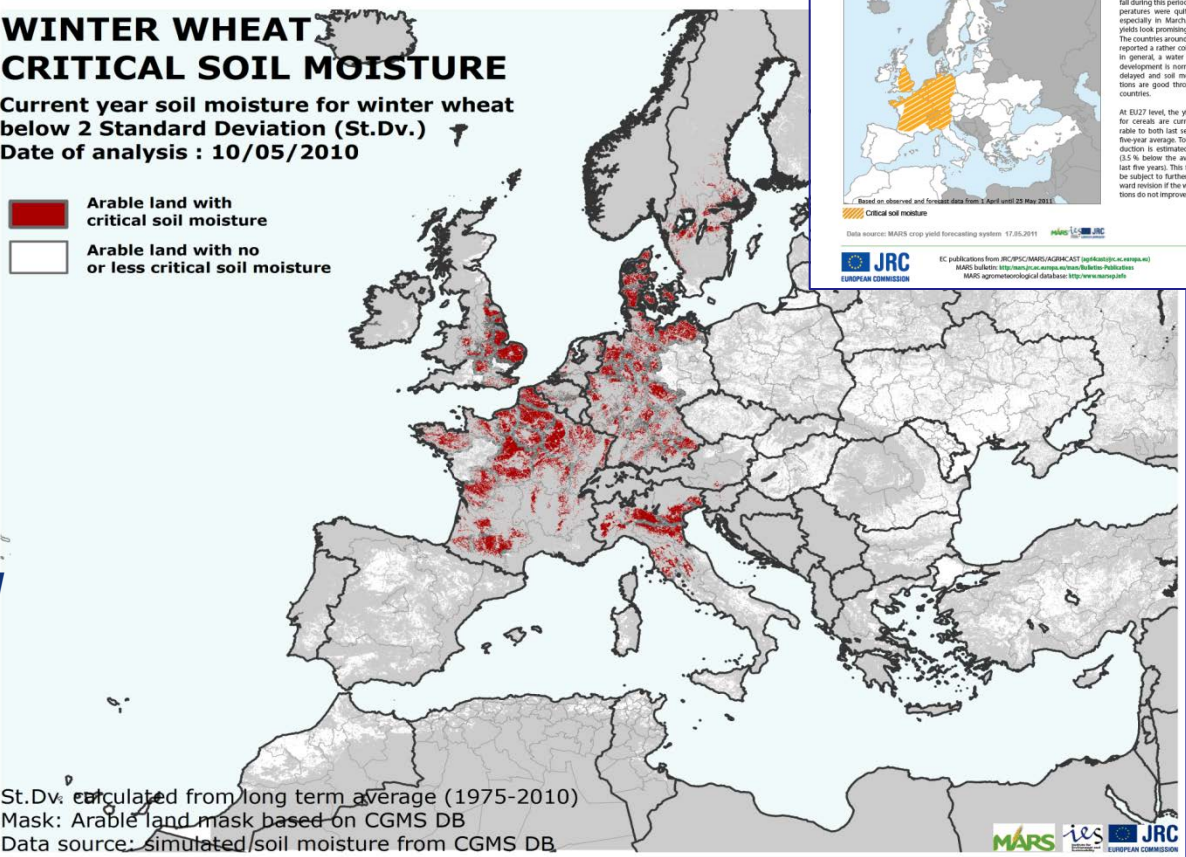
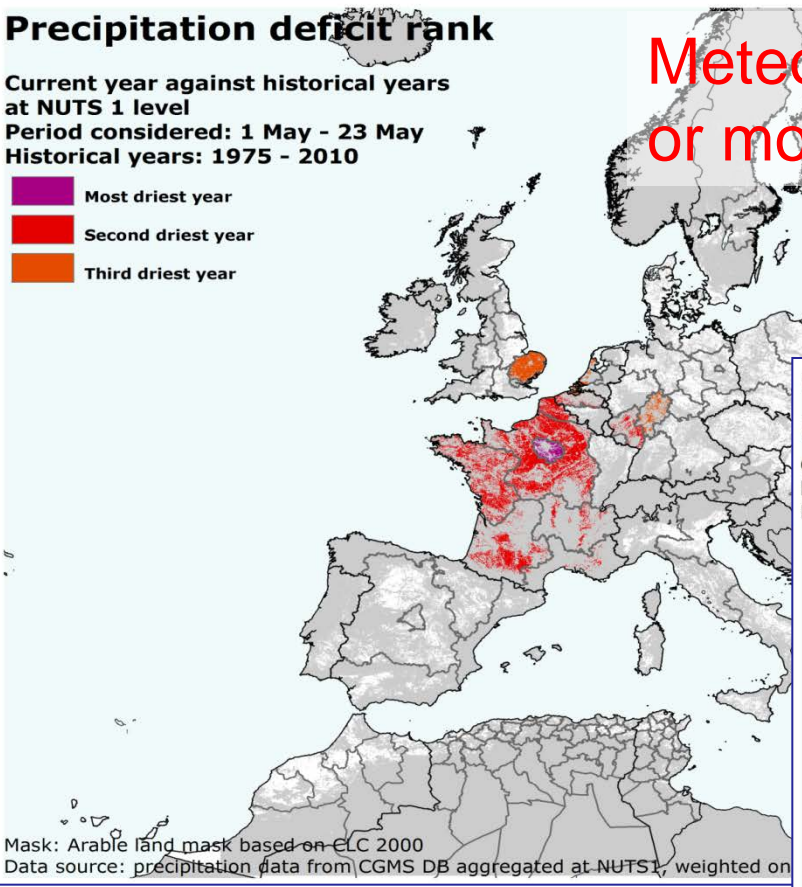
At EU27 level, the yield prospects for cereals are currently comparable to both last season and the five-year average. Total cereal production is estimated at 265.6 Mt (3.5 % below the average for the last five years). This forecast could be subject to further sharp downward revision if the weather conditions do not improve.

**AREAS OF CONCERN**

Based on observed and forecast data from 1st April until 23 May 2011.

Legend: Critical soil moisture

Logos: JRC, ires, MARS



**MARS reports weekly to DG AGR**  
 on the development of the situation over Europe and neighbouring countries



Spot VGT data at 1km -> NDVI, fAPAR 1st dekad of June

NDVI anomaly (%) = (NDVI 2011 – NDVI mean 99-2010) / NDVI mean 99-2010

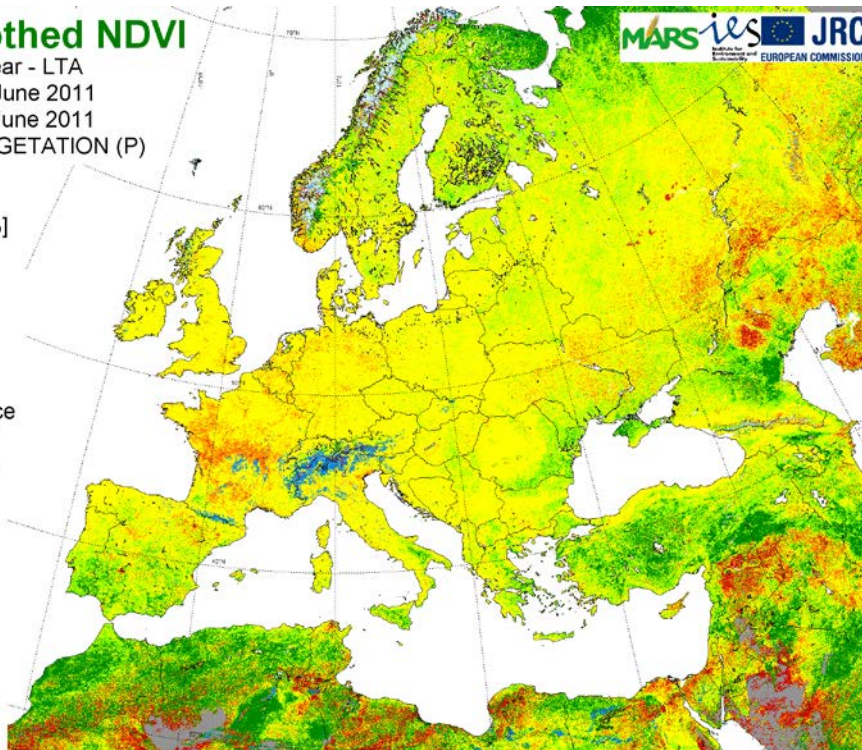
## Smoothed NDVI

Current year - LTA  
from: 01 June 2011  
to: 10 June 2011  
SPOT-VEGETATION (P)

Rel.Dif. [%]  
■ < -25  
■ < -10  
■ ±  
■ > +10  
■ > +25

■ Snow/Ice  
■ Clouds  
■ Missing

Produced by VITO (BE)  
on behalf of the  
AGRICAST and/or  
AGRICULTURE unit  
on 12 June 2011



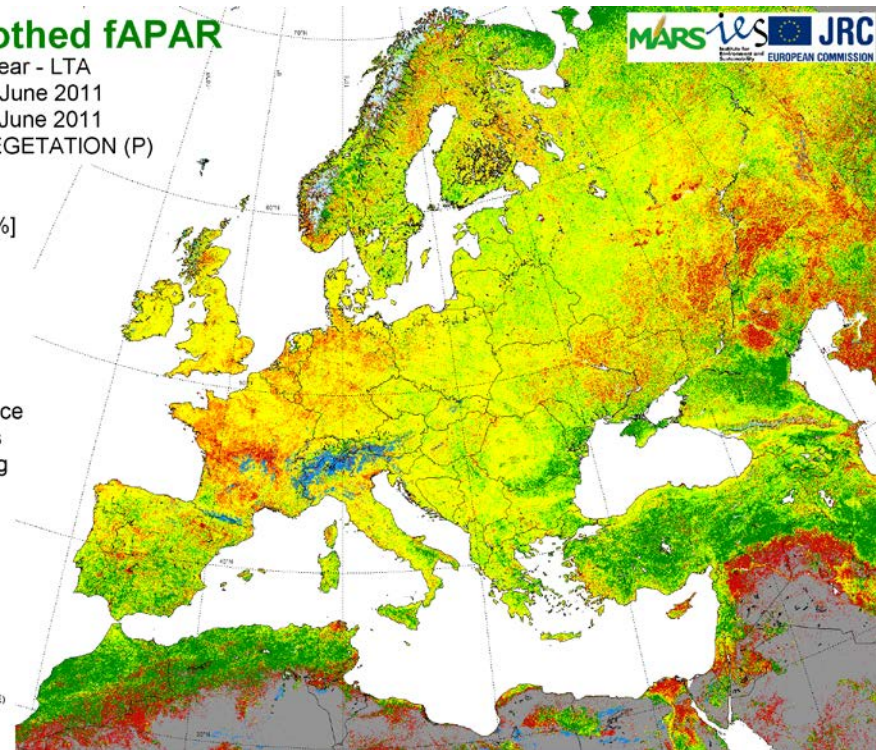
## Smoothed fAPAR

Current year - LTA  
from: 01 June 2011  
to: 10 June 2011  
SPOT-VEGETATION (P)

Rel.Dif. [%]  
■ < -25  
■ < -10  
■ ±  
■ > +10  
■ > +25

■ Snow/Ice  
■ Clouds  
■ Missing

Produced by VITO (BE)  
on behalf of the  
AGRICAST and/or  
AGRICULTURE unit  
on 12 June 2011







Date of issue: 20 August 2010

**Crop season delayed in the Western Lowlands, satisfactory situation in the Central Highlands**



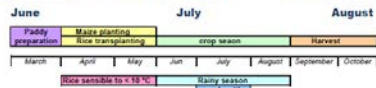
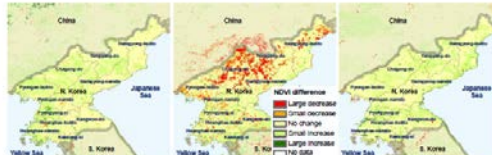
This year, the rainy season started late with the first significant rainfalls recorded only in the 1<sup>st</sup> decade of July. Rainfalls resumed since the 2<sup>nd</sup> decade of July, with even heavier rains so that floodings were reported in some areas of Gash-Barka. Above normal rainfalls were recorded in all the Gash-Barka and Maekel regions, and in parts of the Debub region (Fig. 1). Below normal rains of June and early July in Gash Barka have delayed the onset of the crop season and vegetation growth.

The vegetation index (NDVI) of July 2010 shows even worse vegetation condition compared to last year in most of the Gash-Barka region, but better condition in the Debub and Maekel regions (Fig. 2). Comparison with the situation in 2007, which was a good crop season, and with 2002, which was a poor season, indicates that 2010 is similar to 2002 in terms of vegetation development status at this period of the season (Fig. 5). The situation in the Gash-Barka where concentrates most of the mechanized agriculture needs to be closely monitored in the coming days.

Date of issue: 20 September 2010

**Very heavy rainfall affected the country from July to early September causing flooding mainly in the Pyongan, Pyongyang and Hwanghae regions and damages to agriculture. Non flooded agricultural areas are performing well.**

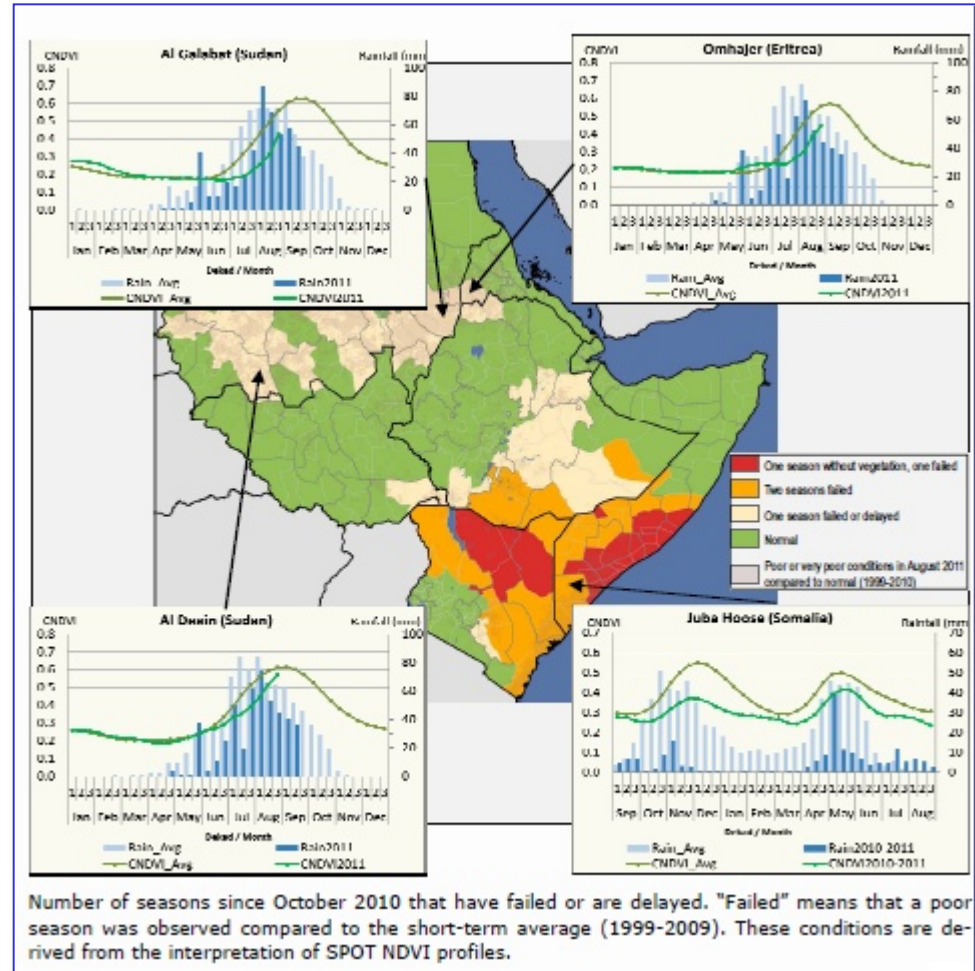
Higher than normal rainfalls were recorded over large parts of DPRK from July to September and in particular in the second half of July but also in the 3<sup>rd</sup> decade of August and the 1<sup>st</sup> decade of September, when the country was hit by the Tropical Cyclone KOMPASU-10. Important food damages to infrastructures and cropped areas have been reported by the news in August (source: KCNA). Unfortunately due to the predominantly mountainous morphology of the country the flooded areas cannot easily be detected on medium and low resolution satellite images (MODIS 250m resolution and SPOT VEGETATION 1km resolution) which makes flood impact assessment more difficult. At the regional NDVI profiles for rice and Maize areas are generally above average and there is no visible effect of flooding on crop performance. On the other hand, the extremely high rainfall of early September could negatively affect rice and maize ripening and harvesting.



Figures 1. NDVI difference with the 11 years average (1999-2009) for the months of June, July and August 2010. Below a general crop calendar. Negative values in July are linked to intense cloud cover.

JRC European Commission logo and contact information for the MARS Unit.

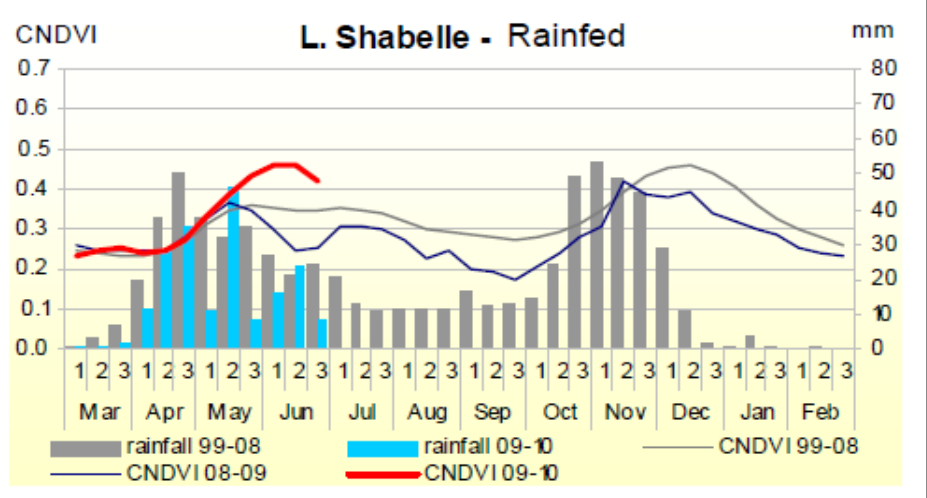
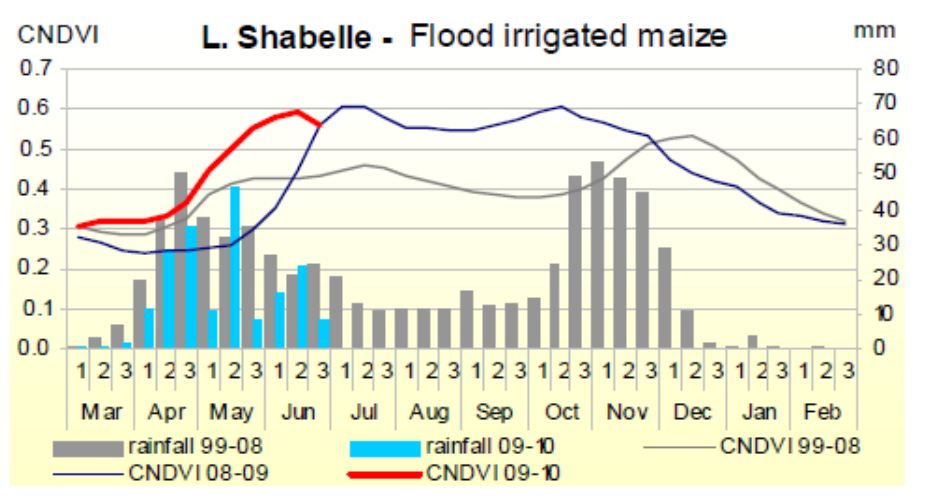
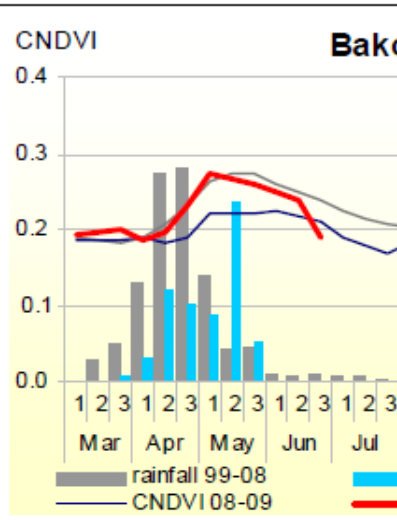
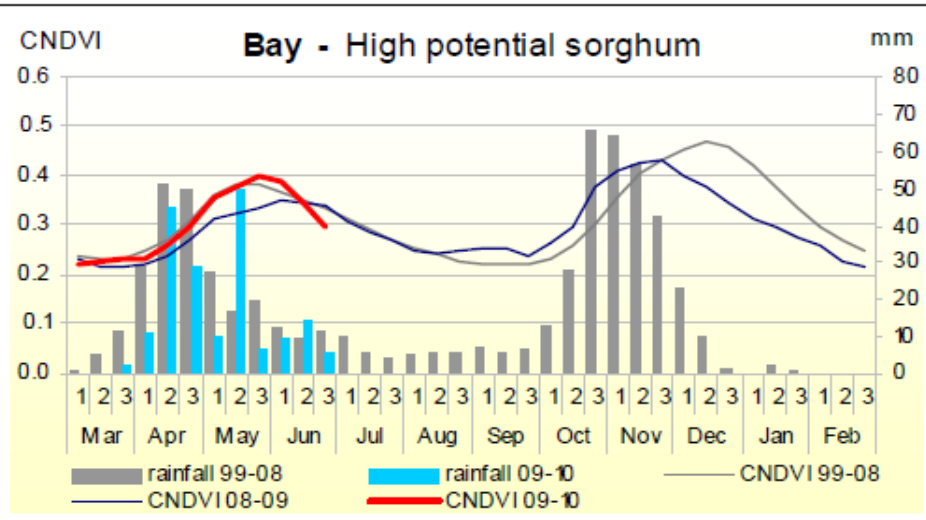
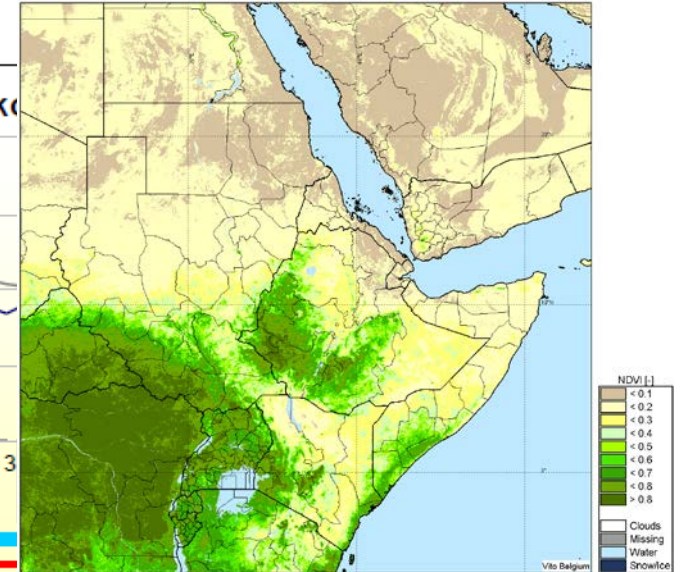
## Crop monitoring / food security bulletins on specific countries according to need and demand



Number of seasons since October 2010 that have failed or are delayed. "Failed" means that a poor season was observed compared to the short-term average (1999-2009). These conditions are derived from the interpretation of SPOT NDVI profiles.

## Ex: Somalia 2009 vs 2008 & mean 99-08

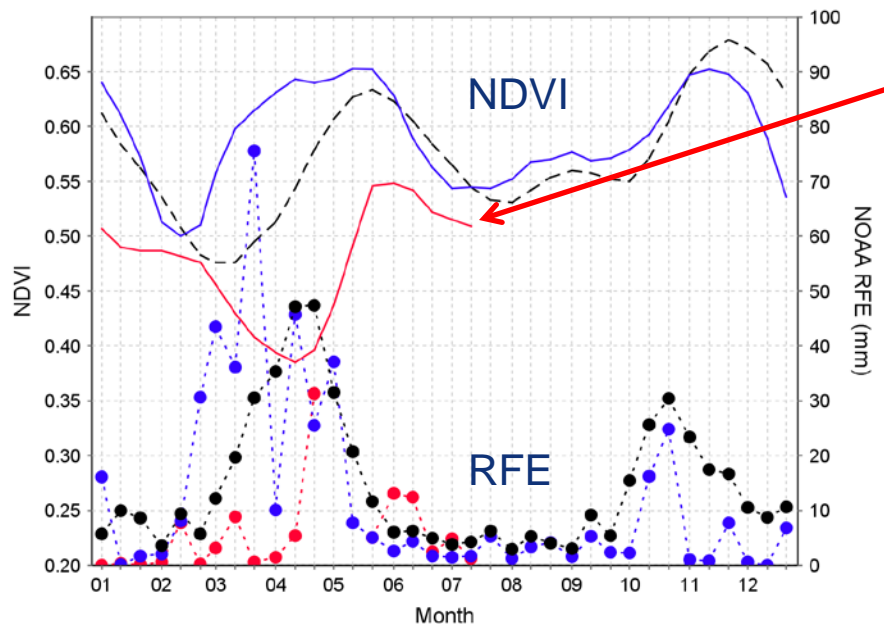
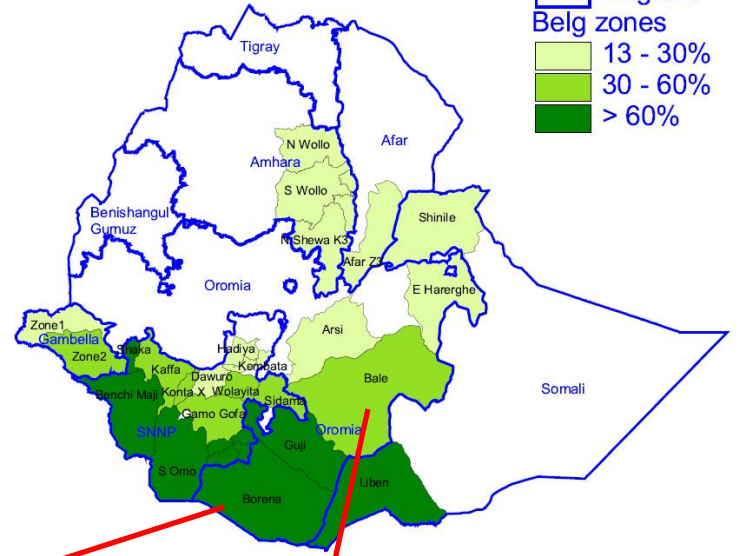
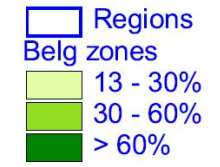
Region: East Africa: IGAD-States, Burundi and Rwanda  
 Period: June, 2009  
 Theme: Normalized Difference Vegetation Index (NDVI)  
 Maximum value in period  
 Source: SPOT-VEGETATION



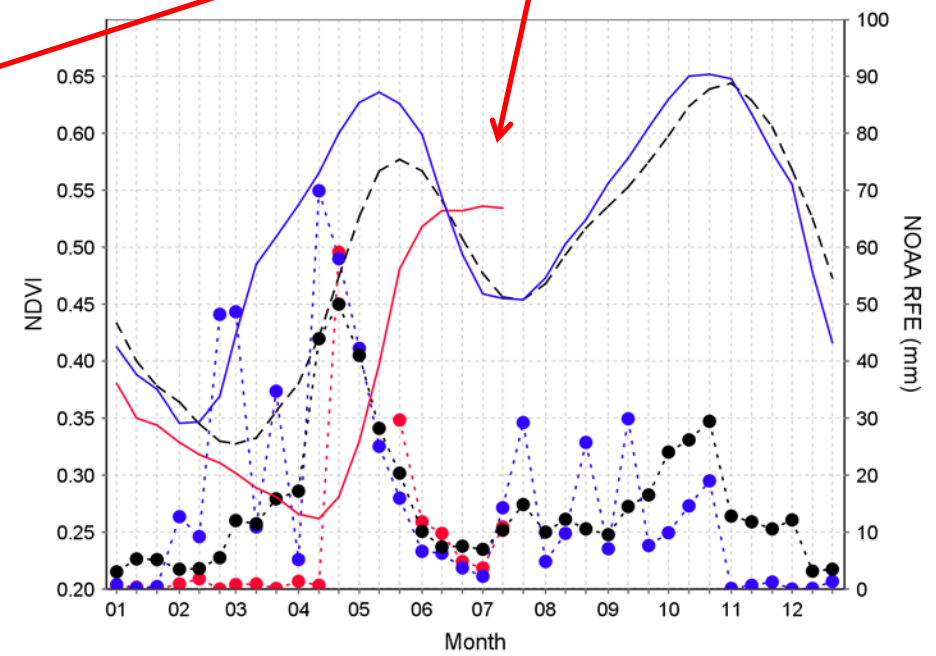
Need to focus on the right area and time (crop season)



# 2011 drought in Ethiopia



— Borena NDVIc 2010 — Borena NDVIc 2011 - - Borena NDVIc LTA-MEAN  
 ● Borena NOAA RFE LTA-MEAN ● Borena NOAA RFE 2010 ● Borena NOAA RFE 2011



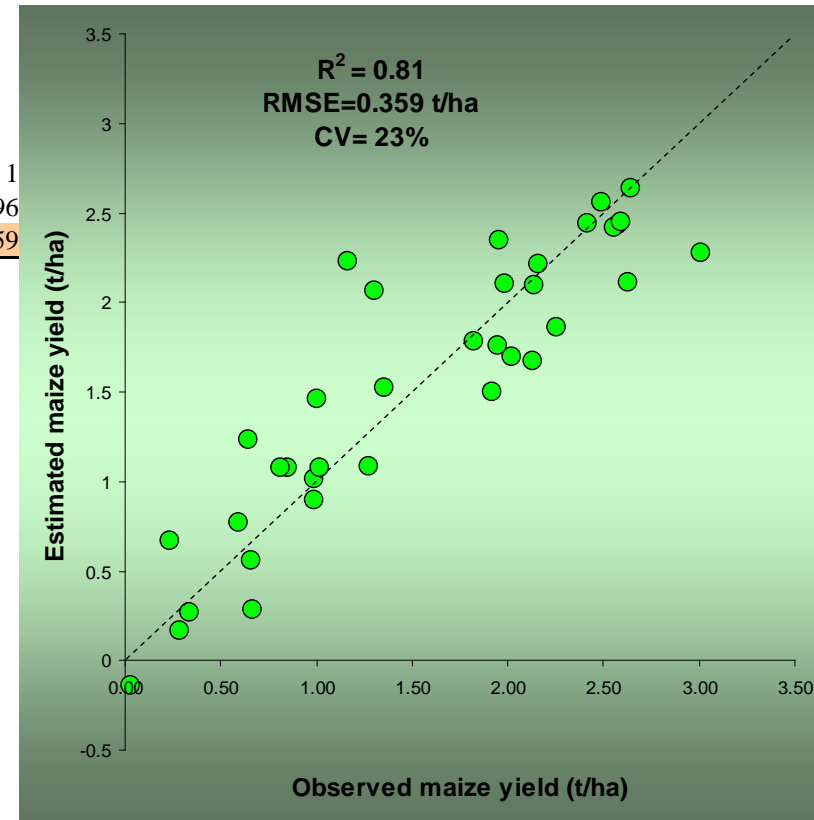
— Bale NDVIc 2010 — Bale NDVIc 2011 - - Bale NDVIc LTA-MEAN ● Bale NOAA RFE LTA-MEAN  
 ● Bale NOAA RFE 2010 ● Bale NOAA RFE 2011 — Bale NOAA RFE 2012

Table Correlation Matrix of maize yield and the independent variables

	WSI	WEXt	WDEFt	ETAi	ETA <sub>v</sub>	ETA <sub>f</sub>	ETA <sub>r</sub>	ETA <sub>t</sub>	Rain	CNDVI <sub>c</sub>	CNDVI <sub>x</sub>	CNDVI <sub>a</sub>	NDVI <sub>c</sub>	NDVI <sub>x</sub>	NDVI <sub>a</sub>
WSI	1														
WEXt	0.13	1													
WDEFt	0.92	0.28	1												
ETAi	0.30	-0.28	0.16	1											
ETA <sub>v</sub>	-0.40	-0.14	-0.38	0.11	1										
ETA <sub>f</sub>	0.85	0.27	0.79	0.31	-0.28	1									
ETA <sub>r</sub>	0.82	0.34	0.81	0.33	-0.28	0.76	1								
ETA <sub>t</sub>	0.86	0.27	0.81	0.39	-0.17	0.98	0.86	1							
Rain	0.38	0.95	0.49	-0.13	-0.22	0.50	0.55	0.52	1						
CNDVI <sub>c</sub>	0.24	0.29	0.12	0.59	0.14	0.52	0.41	0.56	0.41	1					
CNDVI <sub>x</sub>	0.39	0.32	0.36	0.61	0.15	0.43	0.51	0.52	0.42	0.70	1				
CNDVI <sub>a</sub>	0.38	0.27	0.34	0.61	0.08	0.38	0.46	0.46	0.36	0.67	0.95	1			
NDVI <sub>c</sub>	0.18	0.31	0.06	0.58	0.13	0.44	0.34	0.48	0.40	0.98	0.70	0.67	1		
NDVI <sub>x</sub>	0.19	0.25	0.16	0.56	0.09	0.17	0.28	0.24	0.29	0.58	0.90	0.87	0.66	1	
NDVI <sub>a</sub>	0.22	0.21	0.19	0.54	-0.01	0.14	0.25	0.20	0.24	0.51	0.83	0.83	0.60	0.96	1
<b>Yield</b>	0.51	0.35	0.46	0.57	0.06	0.66	0.65	<b>0.73</b>	0.52	<b>0.87</b>	0.78	0.77	0.82	0.59	

Plus recherche qu'application opérationnelle

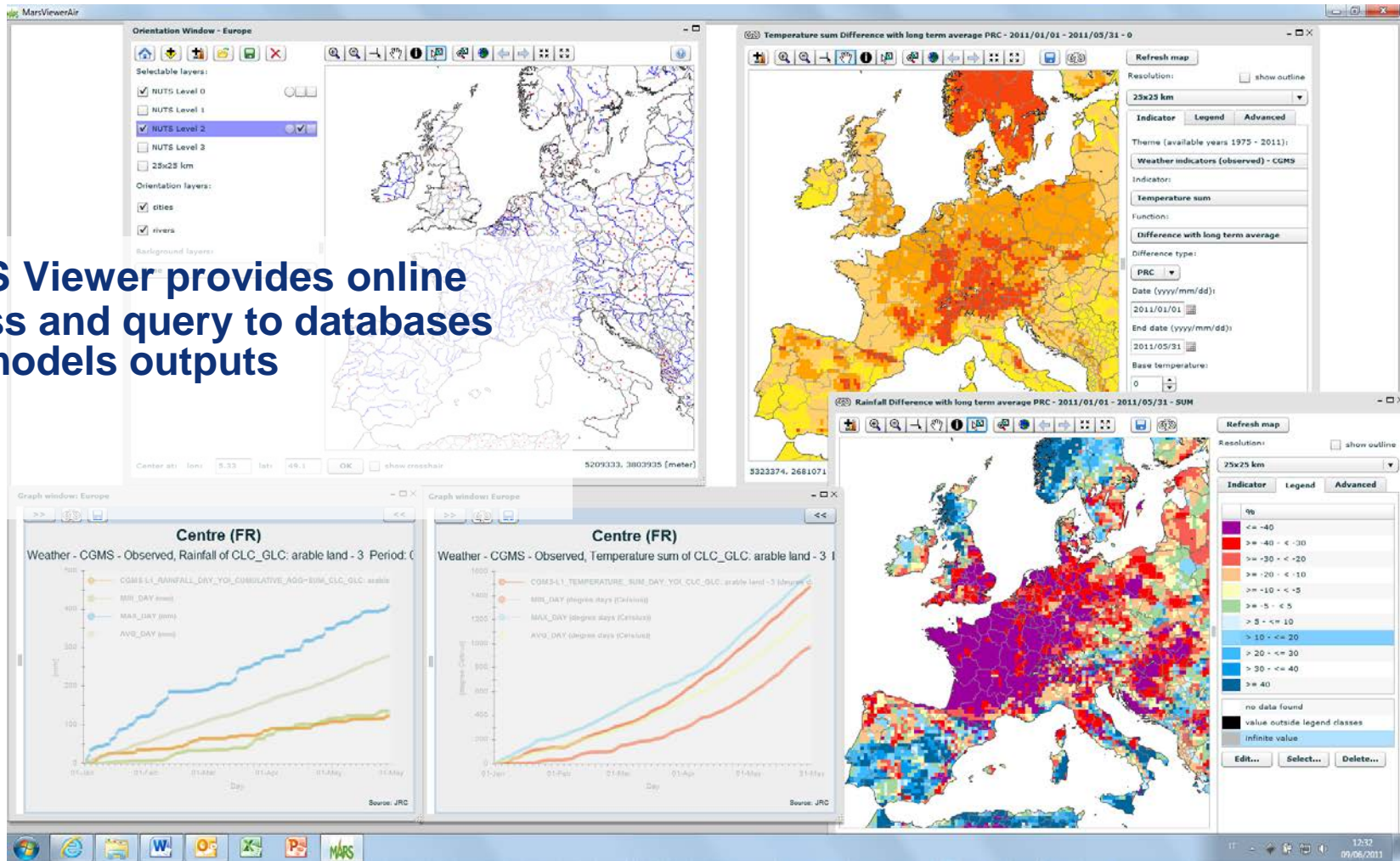
- Similarity analysis
- Regression analysis
  - simple CNDVI yield regression
  - multiple regression with bio-climatic indicators






## MARS system provides efficient user (analyst) interfaces

**MARS Viewer provides online access and query to databases and models outputs**





## APHILIS

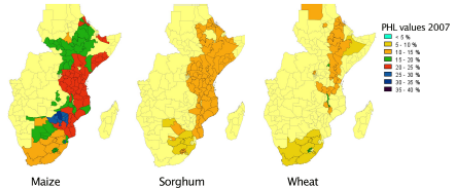
African Postharvest Losses Information System  
– a network for the estimation of cereal weight losses

APHILIS provides transparent estimates of postharvest losses for cereals in Eastern and Southern Africa at national and provincial scale

**Background** Agriculture is being challenging to produce ever more food for a rapidly growing world population. This problem is exacerbated by competition for limited physical resources and the negative impacts of climate change on the environment. Food prices are not expected to decrease in this high demand and high risk scenario, so that postharvest losses (PHLs) have a central role in agricultural monitoring. Reliable PHL figures are important for a better targeting of loss reduction programmes and are essential for the estimation of food availability in countries threatened by food insecurity.

**What the system does** APHLIS provides estimates of weight losses of cereal grains in Eastern and Southern Africa by country and by province. These can be viewed on the APHLIS web site at <http://www.aphilis.net> as interactive maps or as tables of loss values.

**Loss estimates: maps**



**Loss estimates: table**

Regional total PHL for cereals [% of total annual production]							
	2003	2004	2005	2006	2007	2008	2009
	17	14.4	14.3	14.8	15.1	17.4	
Regional PHL by cereal [% of total annual production]							
Cereal	2003	2004	2005	2006	2007	2008	2009
Maize	22	16.4	16.2	17.7	17.8	22.4	-
Barley	9.9	8	9.7	9.7	9.7	-	-
Wheat	13.3	9	13.6	11.5	11	-	-
Sorghum	12.4	12	12.1	12.3	12.2	12.5	-

PHLs are the sum of all the weight losses from each link in the postharvest chain. By convention, they do not include any losses from processing (e.g. milling) and in this system do not include quality losses if food is still fit for human consumption.

## JRC training 28-30 September 2011

Wednesday 28 September

### Training Module 1: MARS Viewer

14:30 – 17:30 Use of remote sensing and agro- meteorological data for crop monitoring.

Production of Anomaly maps and seasonal profiles

TBC Introduction to FAO E-learning (in general and/or “Crop monitoring and EO components”)

Thursday 29 September

### Training Module 2: SPIRITS (Software for Processing and Interpreting Raster Image Times Series)

9:00 presentation of the tool

10:00 access to input data: E-station, Devcoast, FEWSNET data portal...

- Practical session 1

11:00 importing input data from different sources

12:00 computing the historical average and anomaly maps

12:30 Lunch

- Practical session 2

14:00 – 17:00 exercises

- Customized methods, tools
- IPC
- National and regional bodies

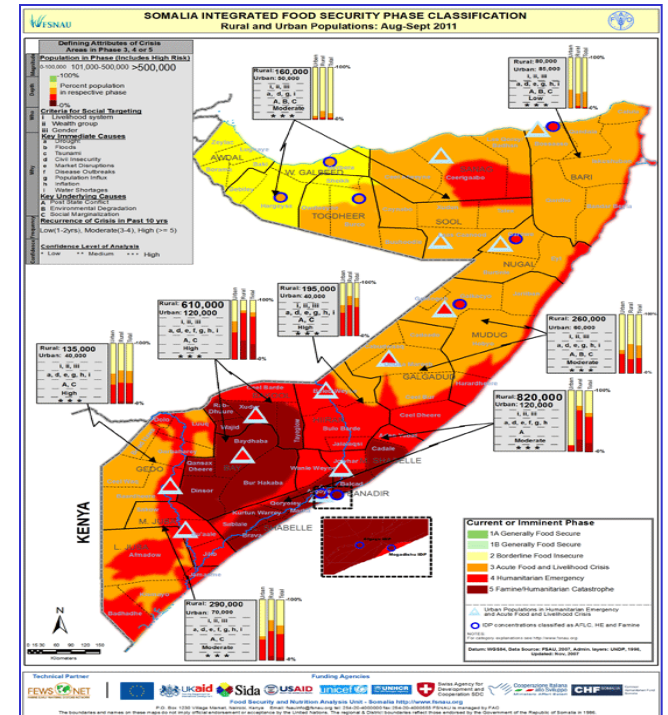


The recent declaration of famine in Somalia followed an IPC process.

The Famine IPC class is based on 3 main outcome indicators:

- Global Acute Malnutrition >30%,
- Crude Death Rate >2/10,000/day, and
- at least 20% of households facing extreme food shortages with limited ability to cope.

IPC maps the present situation, characterizes its likely evolution and is regularly updated.



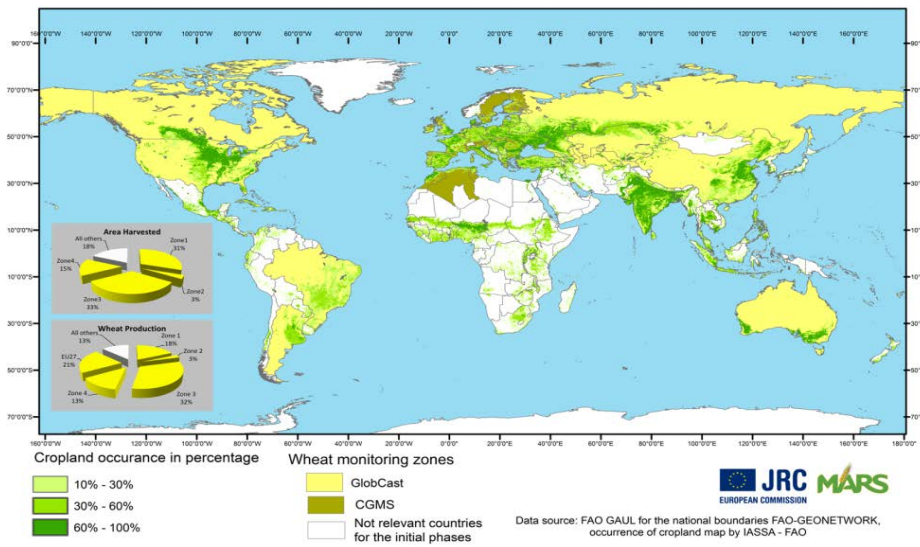
Evidence and Standards for Better Food Security Decisions

## Feasibility study to cover the globe

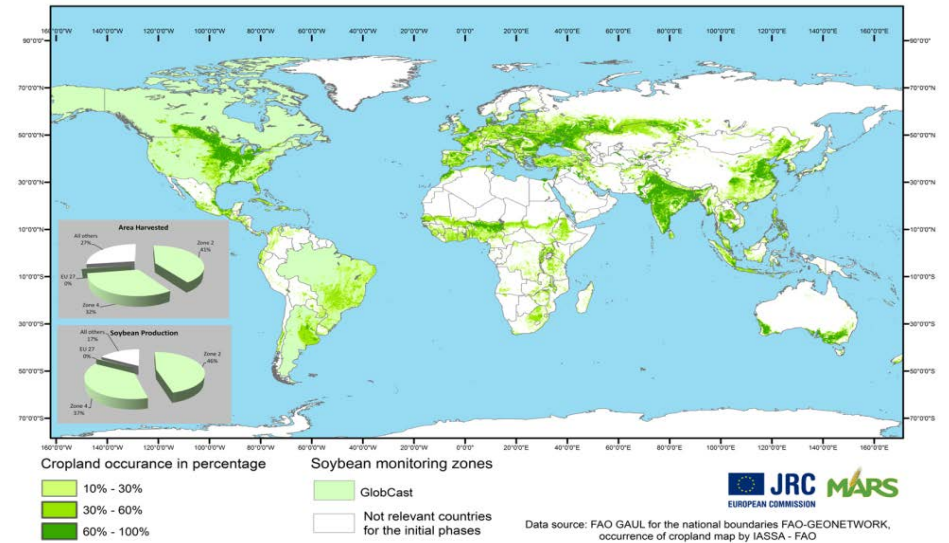
- Monitor the impact of weather in the main grain producing areas
- Produce short-term forecasts

4 zones of the world  
main crops of interest:  
wheat, barley, rice,  
maize, rape seed,  
soybean, sugar cane

GLOBCAST WHEAT MONITORING



GLOBCAST SOYBEAN MONITORING







**Ministerial Declaration**  
**ACTION PLAN ON FOOD PRICE VOLATILITY AND AGRICULTURE**

**Meeting of G20 Agriculture Ministers**  
**Paris, 22 and 23 June 2011**

1. We, the G20 Agriculture Ministers, meet today to address the issue of food price volatility with the ultimate objective to improve food security and agree on an "Action Plan on food price volatility and agriculture" that will be submitted to our Leaders at their Summit in November 2011.

2. Food security will remain a critical issue for the international community. In order to tackle the food security challenge, important commitments and actions have been taken, in particular at the L'Aquila Summit, the 2009 World Food Summit in Rome and the G20 Summits. All countries have stressed the need for improved and more effective agricultural policies at the global and national levels, better international coordination and concrete implementation of political commitments to promote food security and sustainable agricultural production. They have achieved a wide consensus and made progress in reforming the Committee on World Food Security (CFS), implementing the Global Partnership for Agriculture, Food Security and Nutrition and, for those involved, carrying out the L'Aquila Food Security Initiative.

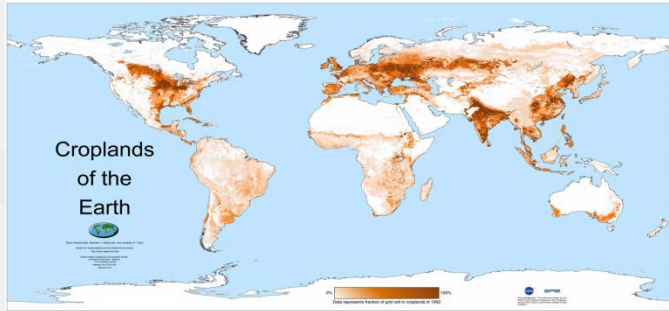
3. The situation is still worrying, especially in developing countries, and many challenges remain. World population is projected to reach more than 9 billion by the middle of this century. Much of this increase is projected to occur in developing countries which currently face the greatest level of food insecurity. In this regard, we recall our commitments to support the Five Rome Principles for Sustainable Global Food Security presented at the World Summit on Food Security in November 2009.

4. We reaffirm the right of everyone to have access to safe, sufficient and nutritious food, consistent with the progressive realization of the right to adequate food in the context of national food security. To strengthen global food security, steps must be taken to improve access and availability of safe and nutritious food for the most vulnerable, particularly women and children in developing countries, through for instance national food security programs.

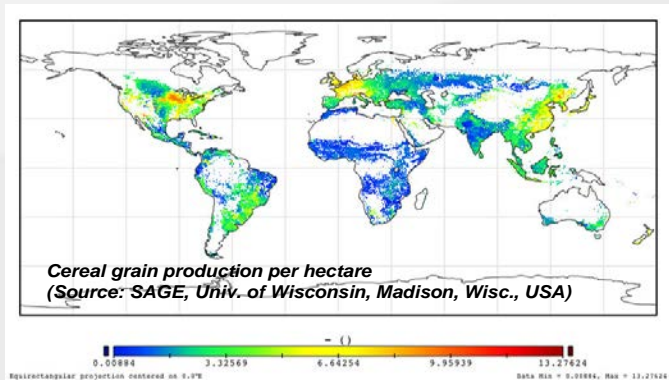
- A detailed action plan, incl. 2 initiatives to increase market transparency:
  - Agricultural Market Information System
  - Global Agricultural Geo-Monitoring Initiative

# 1. The GEO-GLAM Initiative : objectives

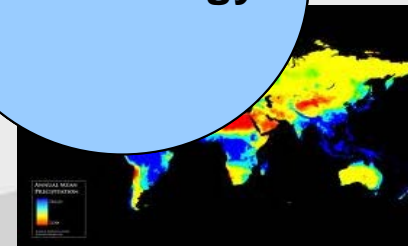
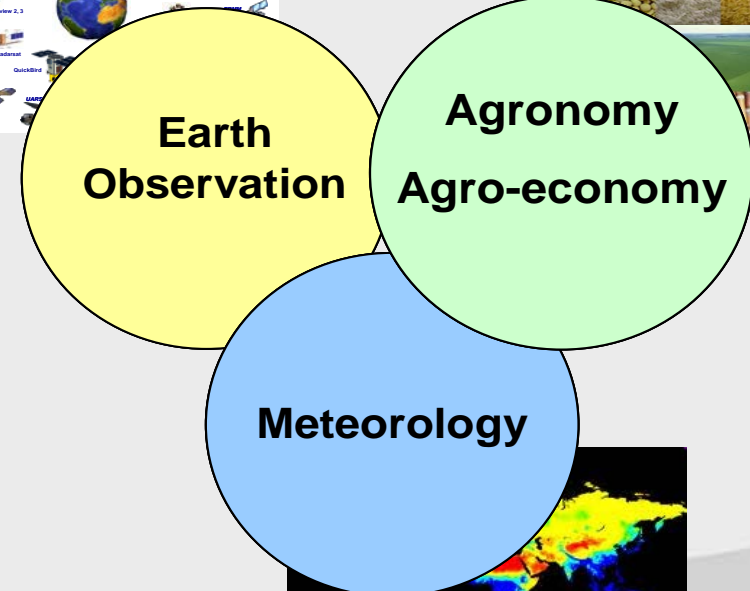
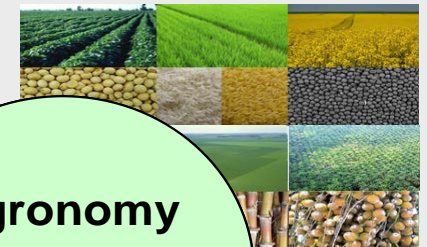
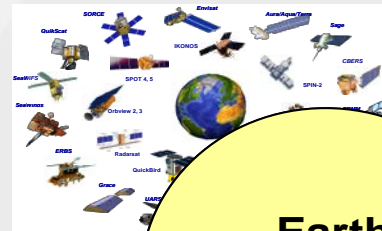
To reinforce the international community's capacity to produce and disseminate relevant, timely and accurate forecasts of agricultural production at national, regional and global scales.



Cultivated area / crop type area



Crop yield forecast



## 2. The GEO-GLAM Initiative : actions

**Action 1. Strengthening national capacities for agric. monitoring** *capacity development for the use of EO, experience sharing, research*

**Action 2. Global and regional agricultural monitoring Systems**  
*Harmonizing, connecting, strengthening inter-comparing existing systems, disseminating information.*

**Action 3. At risk regions and countries agricultural monitoring** *Improving monitoring methods, tools and systems for vulnerable agricultural systems*

**Action 4. Global Earth observation system of systems for agricult.**  
*Developing an operational system : coordinated satellite and in-situ Earth Observation and weather forecasting;*

***Long term commitment. Full and open data policy.***



# 3. Linking

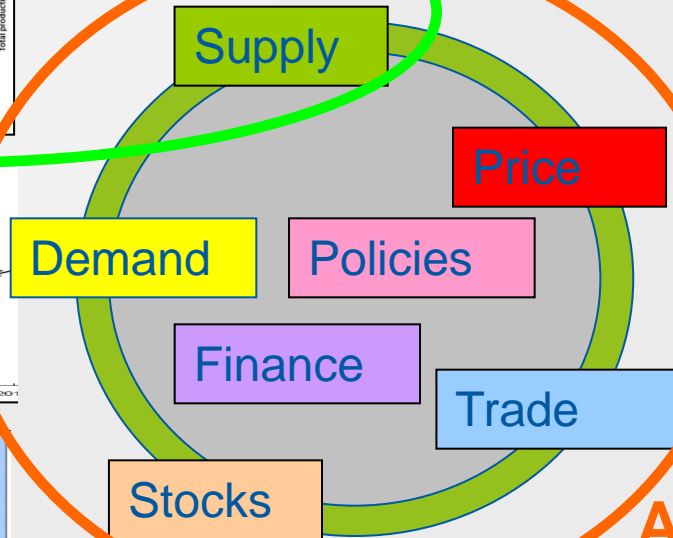
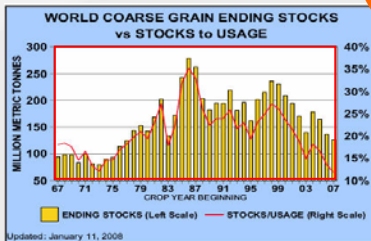
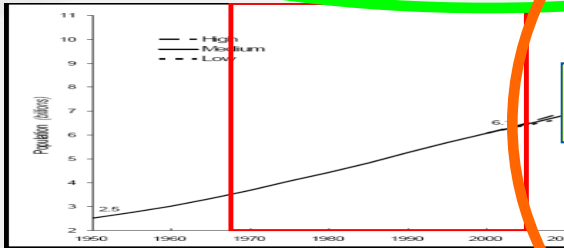
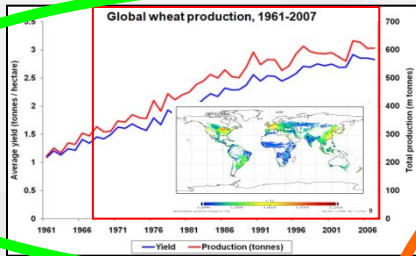


GEO-GLAM  
Global Agricultural Monitoring and



**GEOGLAM**

*International effort to increase information availability, quality and transparency*



**AMIS**

## 4. The GEO-GLAM Initiative : Status and agenda

Jan.- May 2011 :	Initial design in the framework of G20 priorities
June 2011 :	Adoption by G20 Agriculture Action Plan
Sept. 2011 :	International GEO-GLAM meeting at GEO Geneva
Nov. 2011 :	G20 Final Declaration (GEO-GLAM art. 44)
Nov. 2011 :	Presentation at GEO VIII Plenary (90 countries, 60 inst.)
Nov.11 – Feb. 2012 :	Detailed action plan and budget + Governance scheme + Linkage with AMIS
<hr style="border-top: 1px dashed blue;"/>	
March – June 2012 :	Governance definition and approval Linkage with G20 Mexican presidency Securing funds for implementation Informing national and international actors
July 2012 on ... :	Implementation



[Intercomparison of global products; JECAM; EO data access; Capacity building modules](#)

## "Open Session on "Space for Agriculture and Food Security"

Rome, 09 March 2012

World Food Program Auditorium



# Thanks for your attention !

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