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Joint Research Centre

XIII Simpósio Brasileiro de Sensoriamento Remoto

Desenvolvimento Tecnológico e Sensoriamento Remoto: Perspectivas e Desafios

Previsão de Safras e Segurança Alimentar

Jansle V. Rocha

UNICAMP GEO Grupo de Estudos em Geoprocessamento

ipsc AGRIFISH Unit
INSTITUTE FOR PROTECTION AND SECURITY OF THE CITIZEN

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Operational Agriculture Monitoring

AGRIFISH Unit of DG Joint Research Center

MARS-STAT & MARS-FOOD

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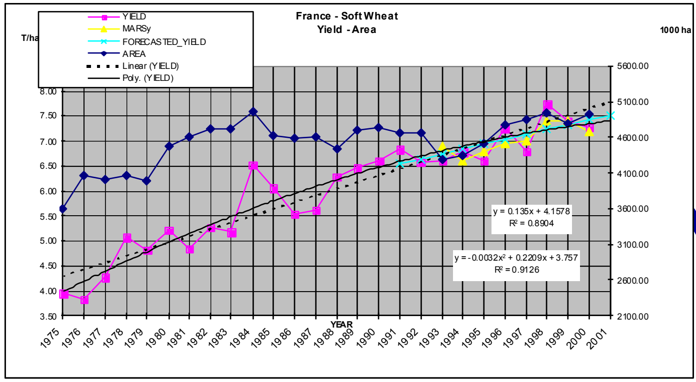
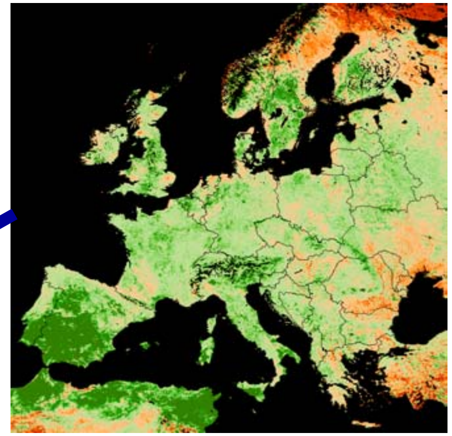
Mars Crop Yield Forecasting System : Input data overview



DB

Statistical analyses: time series, tendency analyses, etc.

Indicators from low resolution satellite data (since 1981)



DB

MARS Yield Forecasts at national level - End of August 2001

	CEREALS YIELD t/ha											
	SOFT WHEAT			DURUM WHEAT			BARLEY			GRAIN MAIZE		
	yield-00	yield-01	%01/00	yield-00	yield-01	%01/00	yield-00	yield-01	%01/00	yield-00	yield-01	%01/00
EU15	6.7	6.6	-0.8	2.6	2.3	-12.9	4.8	4.6	-4.8	9.0	9.0	-0.2
[illegible]	8.0	8.1	1.3	-	-	-	6.3	6.5	2.8	9.6	10.2	6.0
[illegible]	7.5	7.4	[illegible]	[illegible]	[illegible]	[illegible]	5.4	5.1	5.0	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	7.6	[illegible]	5.0	[illegible]	[illegible]	[illegible]	6.1	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2.0	[illegible]	2.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2.6	[illegible]	2.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.9
[illegible]	7.3	7.1	[illegible]	5.0	4.6	[illegible]	[illegible]	5.9	[illegible]	[illegible]	[illegible]	[illegible]
IRL	8.4	8.6	2.7	-	-	-	6.3	6.5	4.0	-	-	-
I	4.7	4.6	-2.8	2.6	2.2	-15.1	3.7	3.4	-7.4	9.5	9.2	-3.5
AT	4.6	4.8	5.2	2.8	3.5	25.6	3.8	4.3	12.6	9.9	9.0	-8.7
P	1.8	1.2	-32.0	1.6	1.2	-24.8	1.4	1.0	-34.0	5.2	5.5	6.2
FI	3.6	3.5	-2.9	-	-	-	3.6	3.2	-9.9	-	-	-
SE	6.0	5.8	-2.8	-	-	-	4.0	3.8	-4.4	-	-	-
UK	8.0	8.1	1.2	6.0	6.0	0.0	5.8	5.7	-1.3	-	-	-

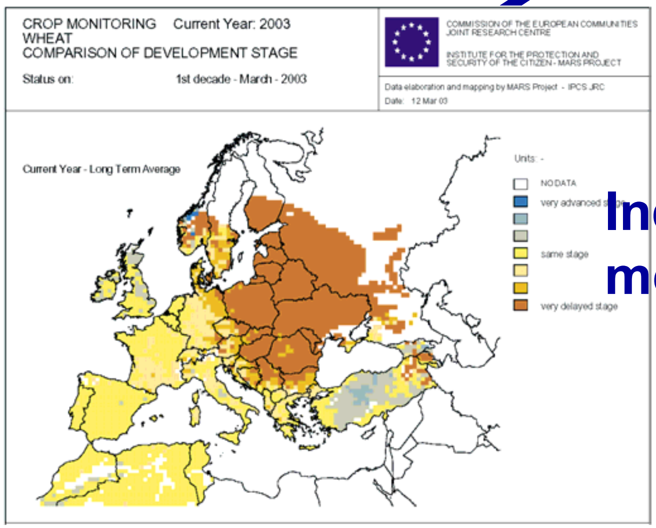
Note: The national yield forecasts are based on agro-meteorological model outputs and AVHRR indicators at NUTS 0 level in combination with time trend analysis. Rape and sunflower yields calculation do not include the areas planted for industrial uses.
Yield: figures are rounded to 100 kg

Yield forecasts

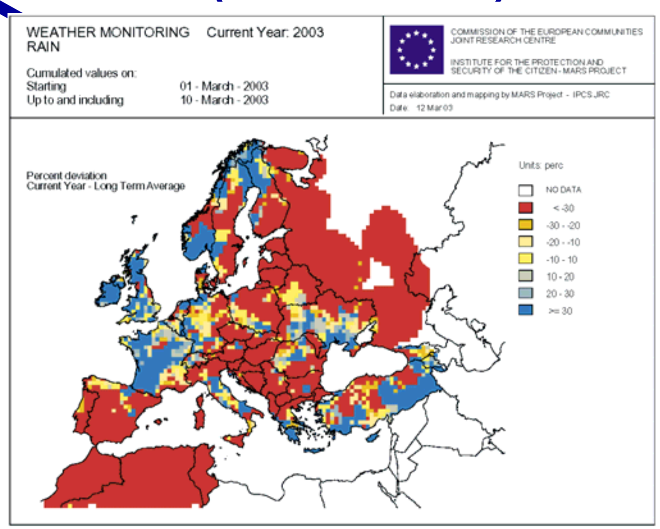
Indicators from meteo data sets (since 1975)

DB

DB



Indicators from agro-meteo parameters



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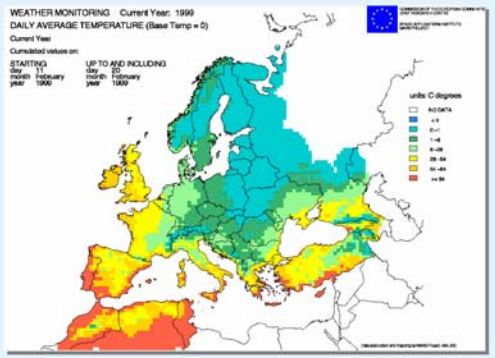
MCYFS: Methodological approach

Level1: Weather Monitoring

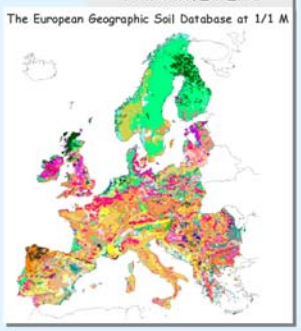
DATA GATHERING QUALITY CHECK → WEATHER PARAMETERS → INTERPOLATION 50x50KM GRID

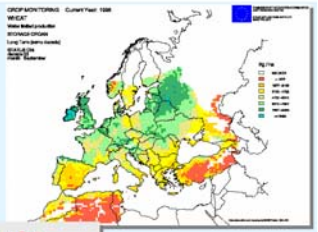


DAILY METEO DATA TO GRID → METEO MAPS ALARM & REGIONAL PRODUCTS

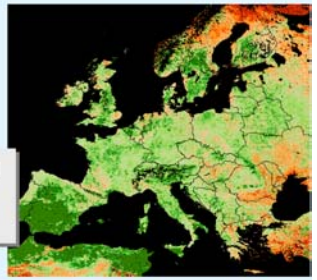
Level2: Crop Simulation

GROUND SURVEYS
AD-HOC STUDIES
CROP PARAMETERS
ADMINISTRATIVE UNITS
SOIL PARAMETERS
CROP GROWTH MODELING





CROP MAPS ALARM, REGIONAL PRODUCTS



LOW RESOLUTION SATELLITE INDICATORS → DECADIC CROP GROWTH INDICATORS

Level3: Yield Forecasting

HISTORICAL STATISTICAL YIELD
REGRESSION ANALYSIS
SCENARIO ANALYSIS
YIELD FORECAST → BULLETIN YIELD PREDICTION

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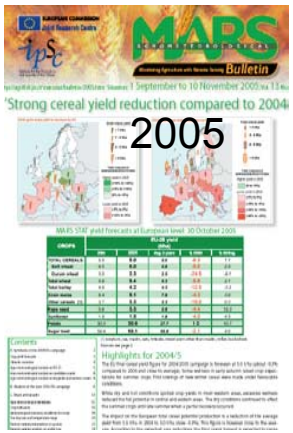
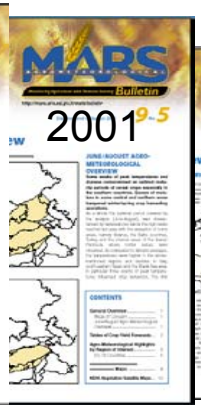
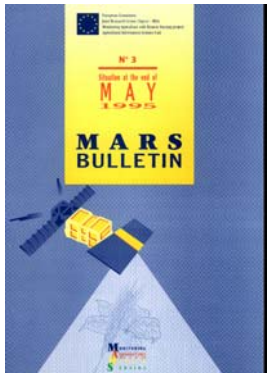
MARS-STAT Bulletins

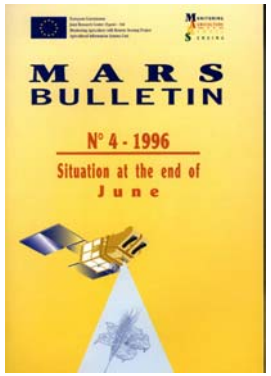
Final results are published in the MARS-STAT bulletins about 20 times a year distributed as:
- Printed issues
- By E-mail and on the Web
http://agrifish.jrc.it/marsstat/Bulletins/2006.htm

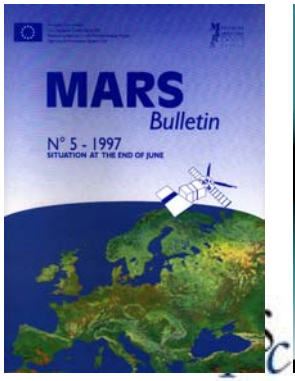


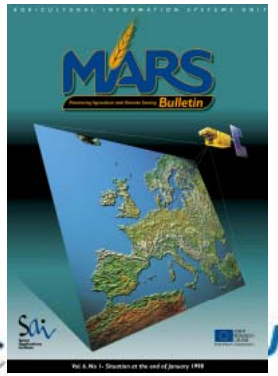


1993 1994 1995 1996 1997 1998









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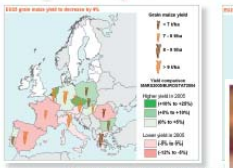
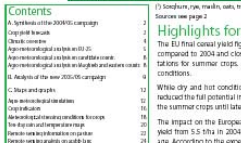
MARS-STAT Bulletin types

Analyses by Countries

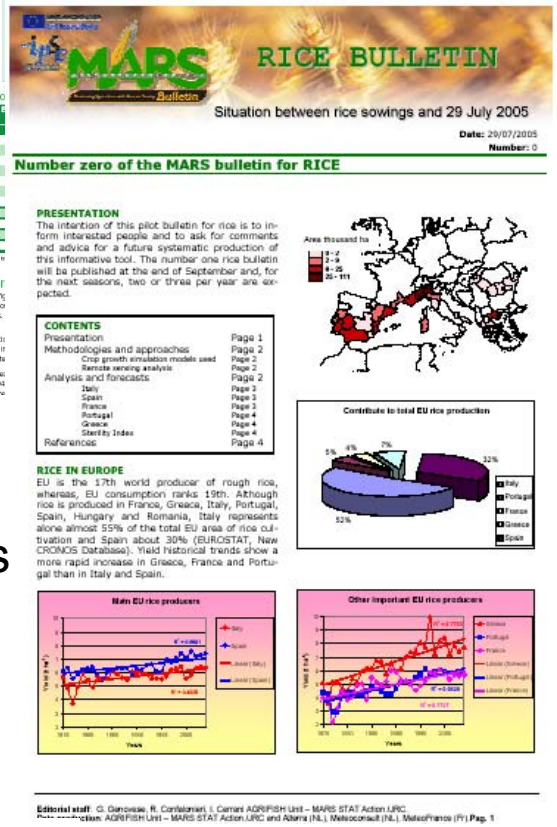


MARS STAT yield forecasts at Euro

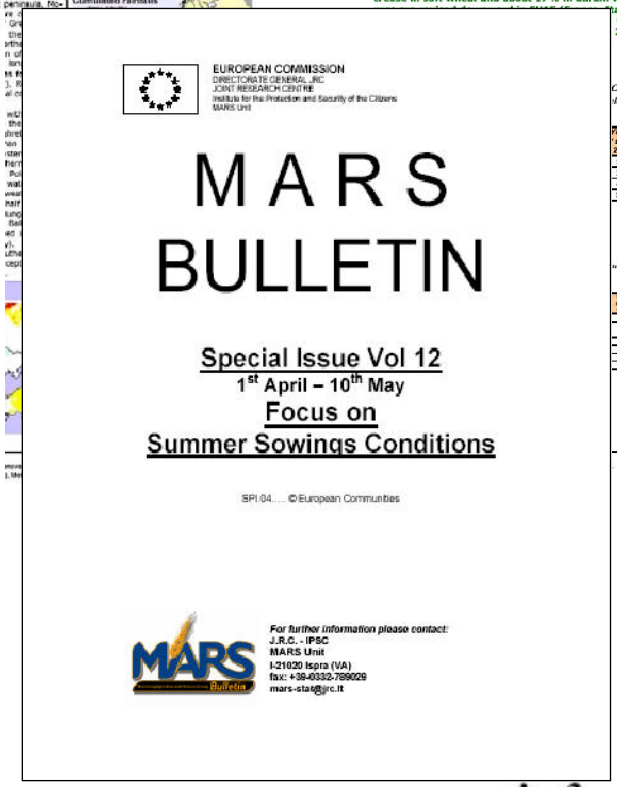
CROPS	2004	2005
TOTAL CEREALS	5.5	5.0
Soft wheat	6.5	6.0
Durum wheat	3.0	2.3
Total wheat	5.9	5.4
Total barley	4.0	4.2
Grain maize	8.4	8.1
Other cereals (1)	3.7	3.3
Rape seed	3.4	3.3
Sunflower	1.9	1.8
Potato	30.3	30.6
Sugar beet	59.4	58.1



Climatic updates and forecasts updates



Rice Bulletins



Special issues

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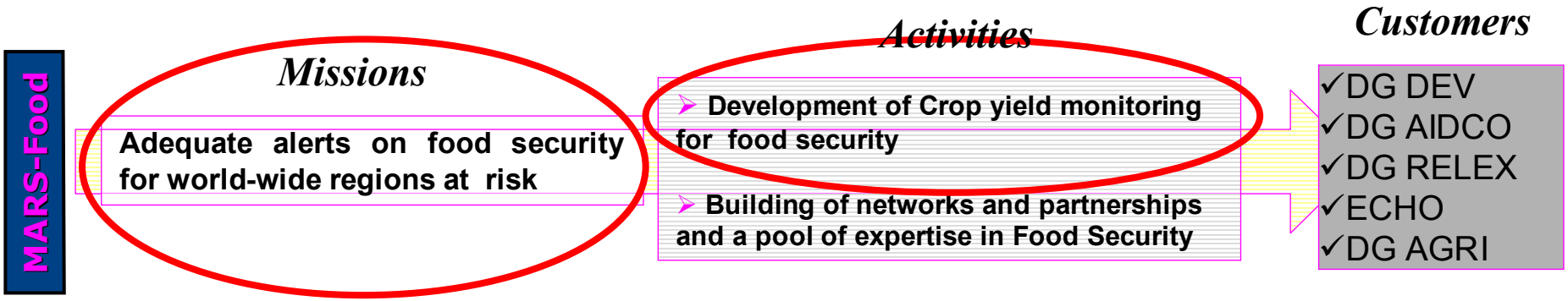
MARS FOOD ACTIVITIES



Objective : Contribute to the EU external aid and development policy, in particular to the EU Food Aid and Food Security policy,

How : by the improvement of the information on crop yield and production in regions of the world affected by food shortages

- **Avoid food shortage or market disruption**
- **Better calibrate and direct European Food Aid**

Could also contribute indirectly to the Agriculture and Trade policies by providing crop prospects information on Russia, Mercosur, etc, …

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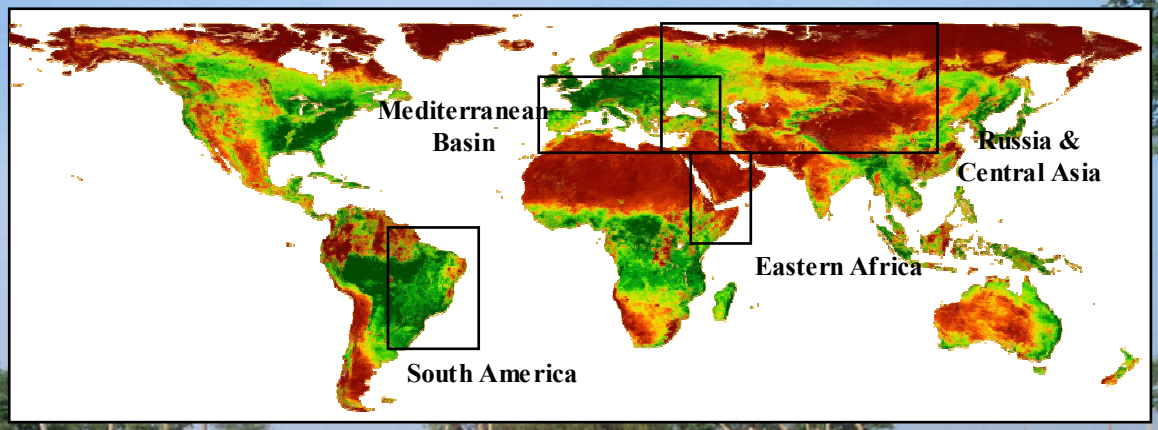
A general view of the MARS-FOOD Crop Monitoring system



Data Coverage of the World

Data analysis on 4 Regions of interest

System based on the use of global remote sensing and meteorological data and on the development of agrometeorological models

In partnership with United-Nations Food and Agriculture Organization (FAO)

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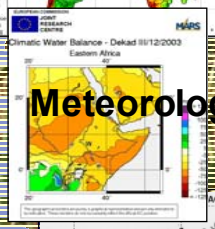
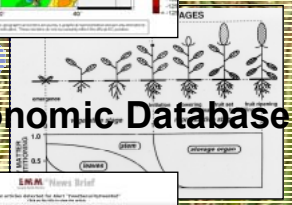
MARS-FOOD Crop Monitoring System

Data collection & retrieval

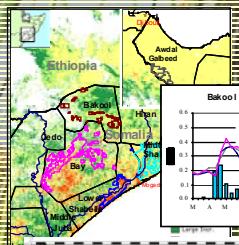

Earth Observation Data

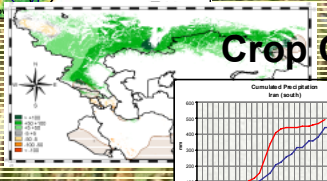

Meteorological Data

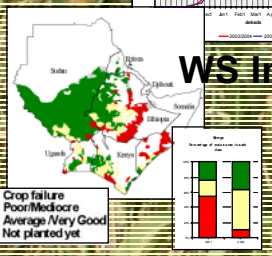

Agronomic Database


WEB Information
European Media Monitor

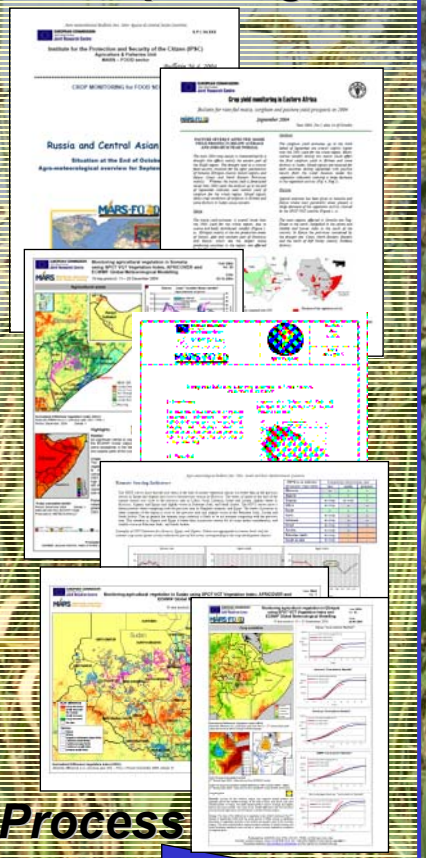
Processing & Analysis


C-NDVI


Crop GMS

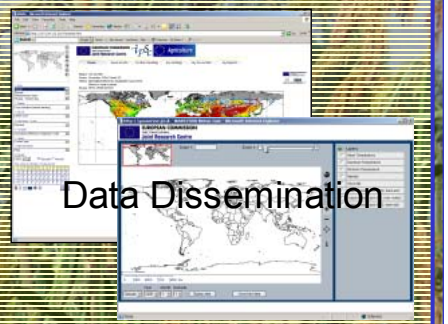

WS Index

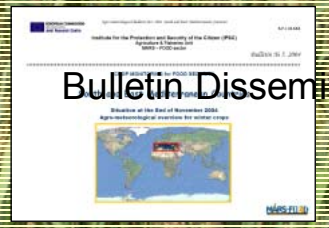
Reporting



Crop Assessment Process

Dissemination


Data Dissemination


Bulletin Dissemination

- DG AIDCO, ECHO, ...
- EU Delegations
- National EW Agencies
- Int. Institutions (FAO, ...)
- ...

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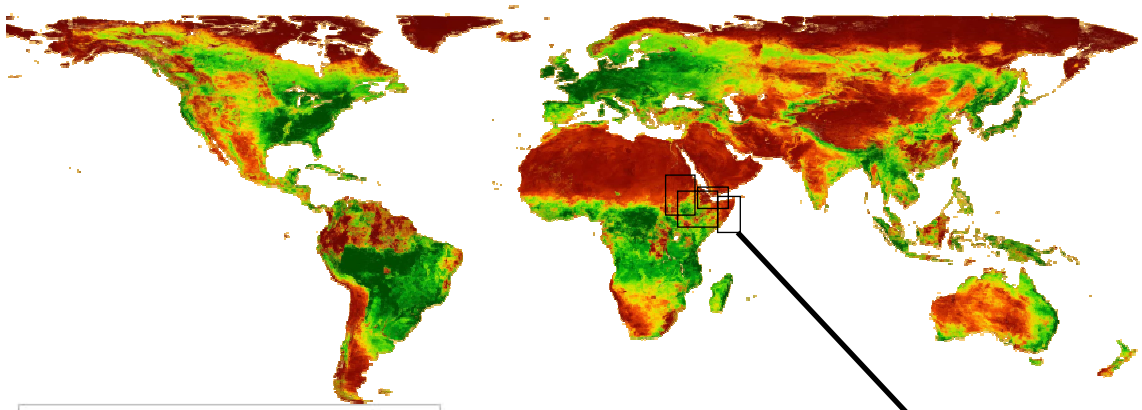
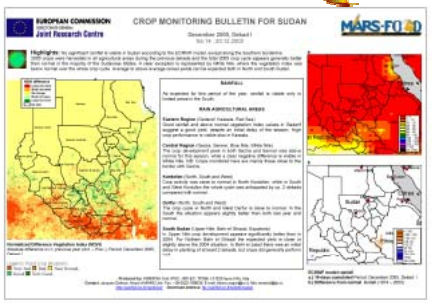
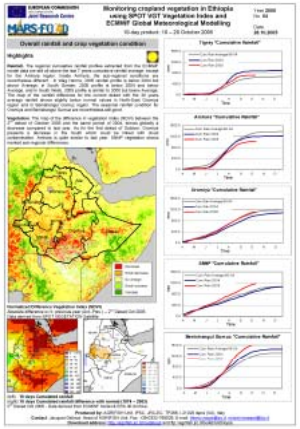
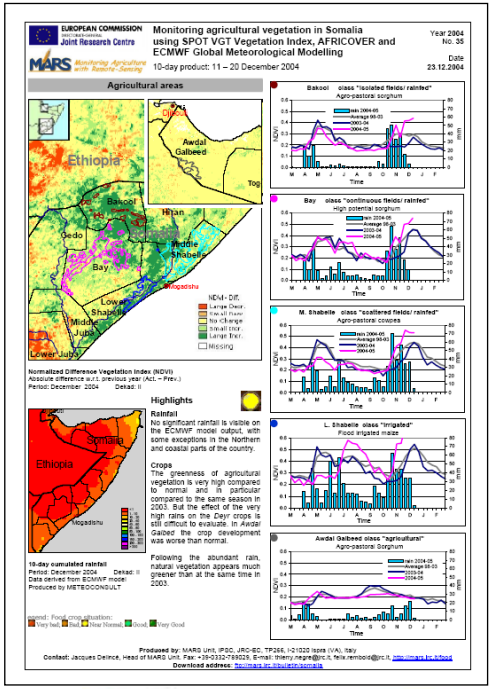
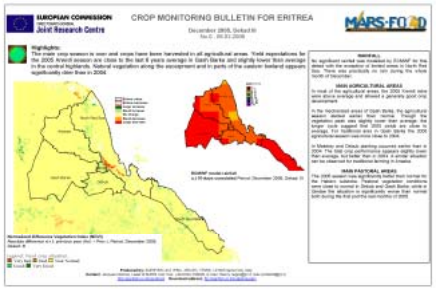
Ten-daily Bulletins, Somalia example











Approach based on C-NDVI profiles and rainfall

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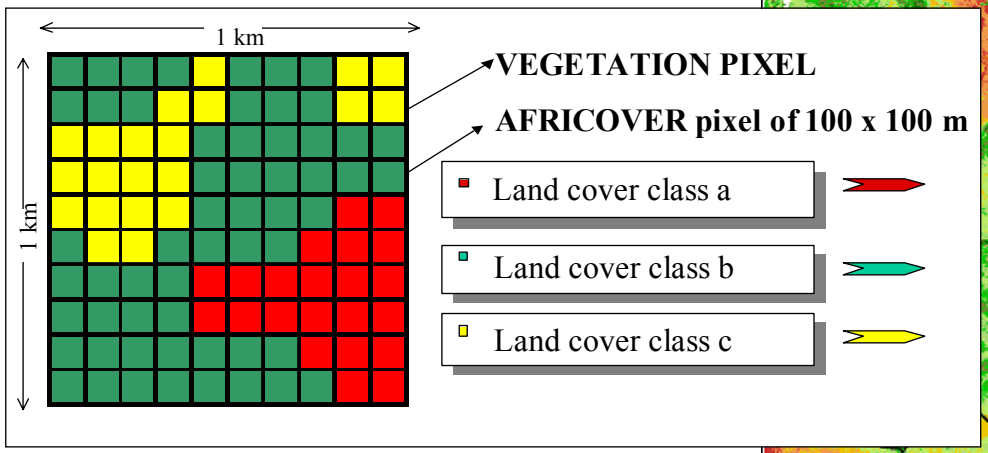
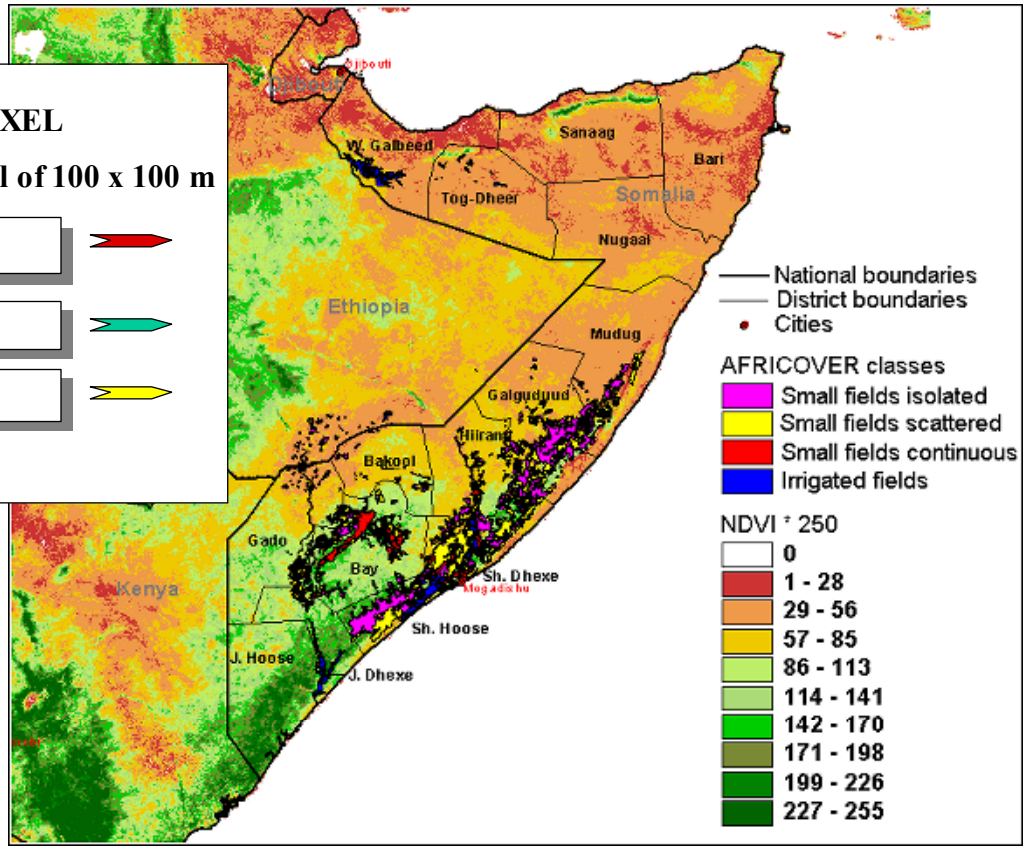
C-NDVI : Weighted NDVI "Unmixing NDVI"

CNDVI with CORINE Land cover + NOAA/AVHRR
AFRICNDVI with AFRICOVER + VEGETATION



$$w_j^r = \frac{P_j^r}{\sum_{j=1}^{n} P_j^r}$$

$$\hat{\mu}^r = \sum_{j=1}^{n} mvcNDVI_j^r w_j^r = AFRICNDVI$$



Goal : Extract the crop component of 1 km VGT NDVI product

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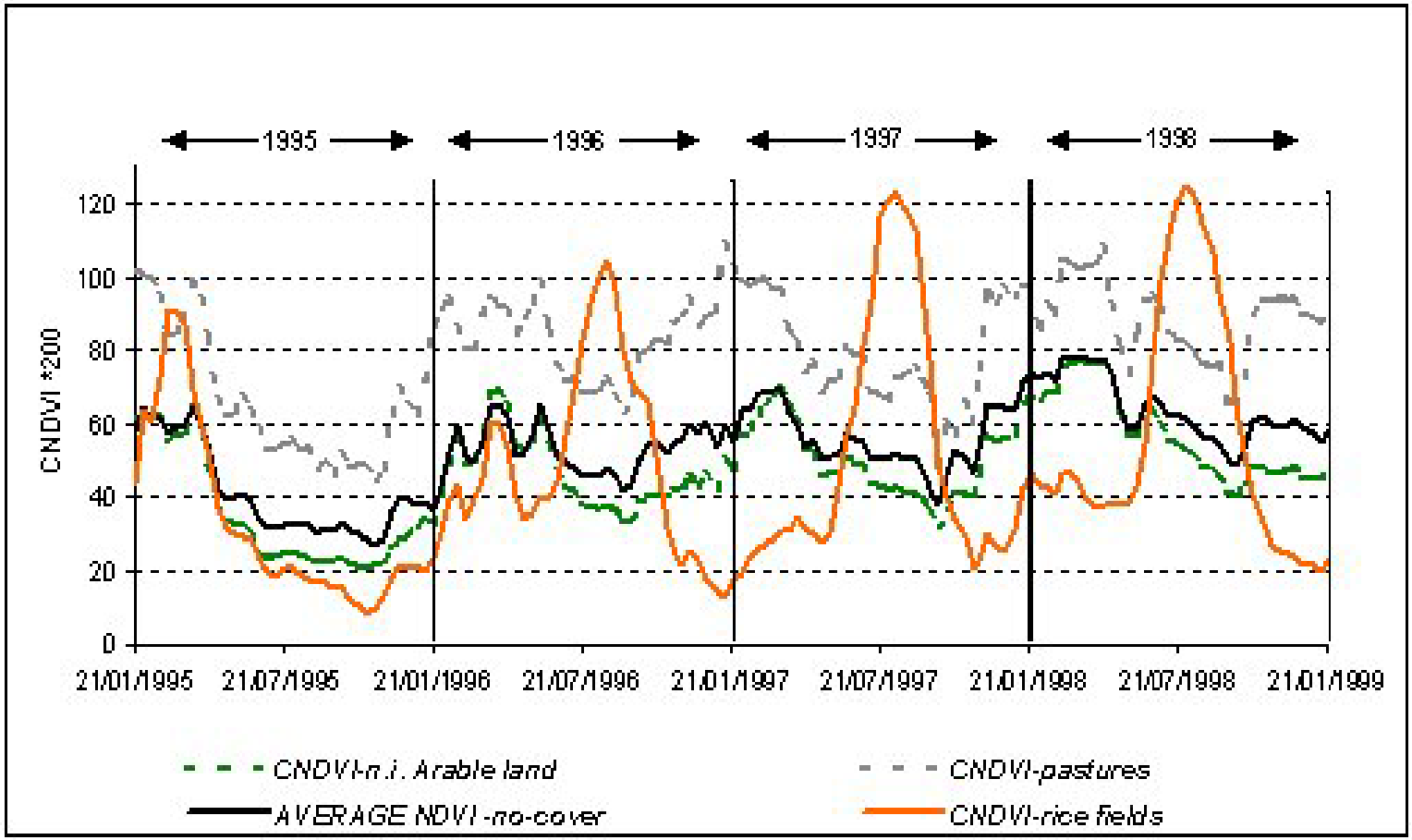
MARS project experience in Europe with CNDVI



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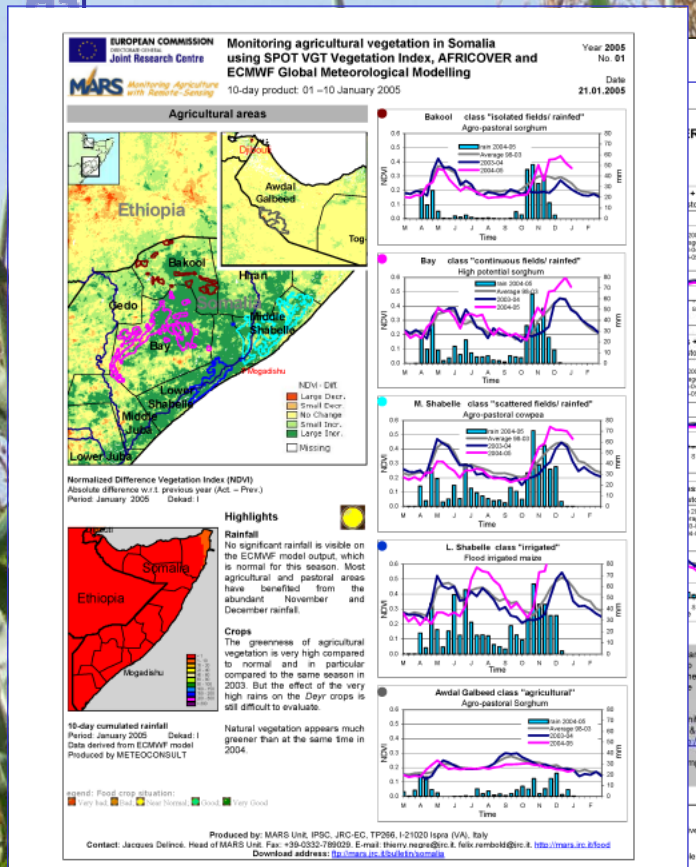
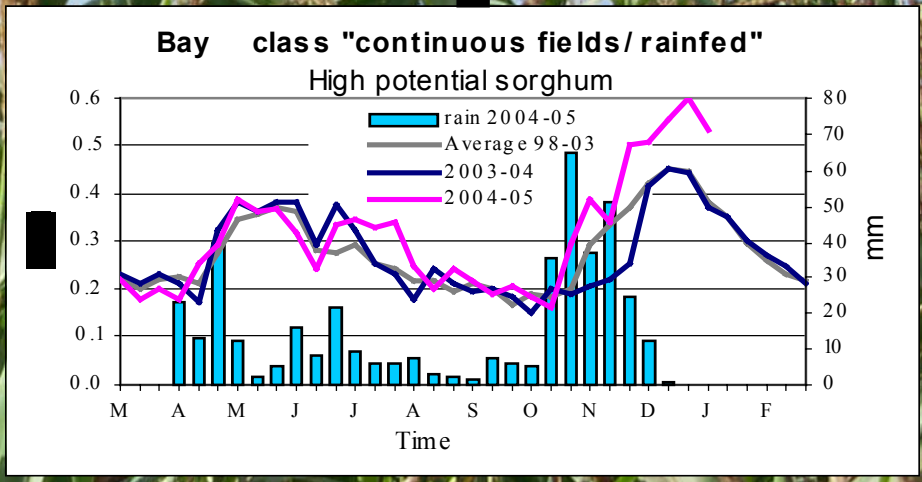
MARS-FOOD Bulletin (Example, Somalia 2004-05)

10-daily country reports
Somalia status 10/01/2005



Forecast for Sorghum Deyr 2005 : expected yield is better than average and previous season.



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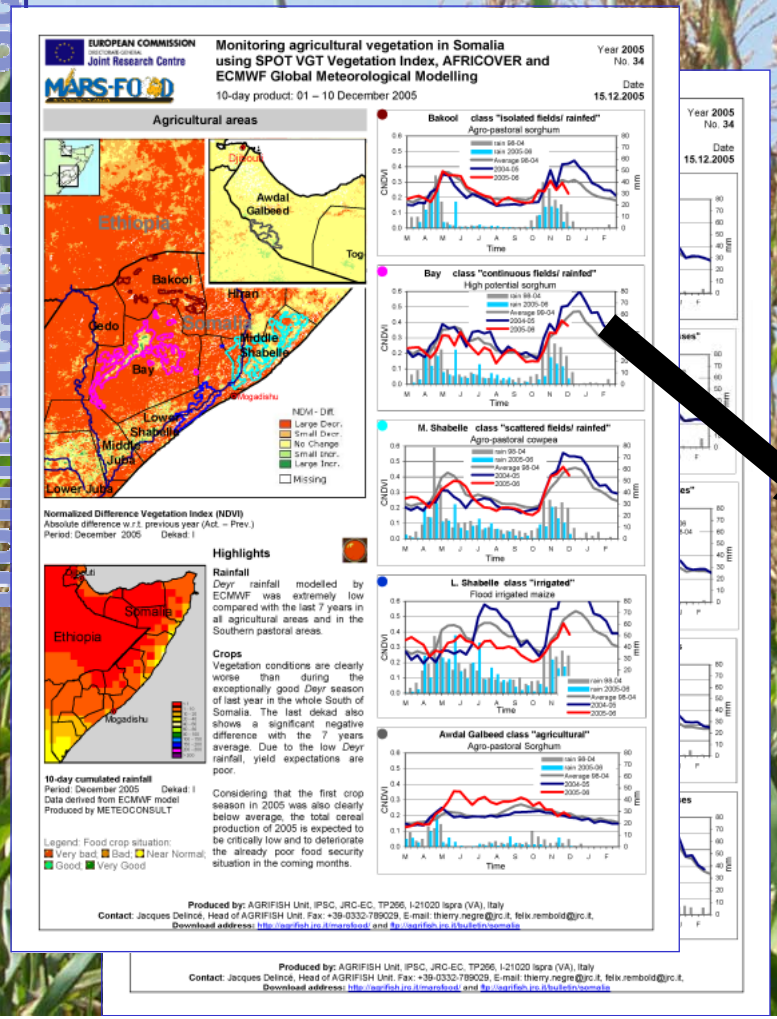
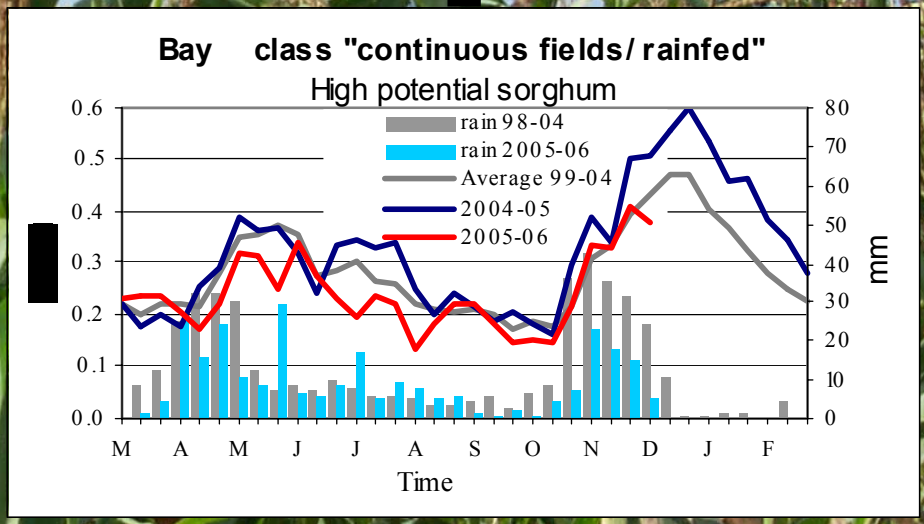
MARS-FOOD Bulletin (Example, Somalia 2005-06)

Joint Research Centre

10-daily country reports
Somalia status 10/12/2005



Forecast for Sorghum Deyr 2006 : expected yield is below than average and previous season.



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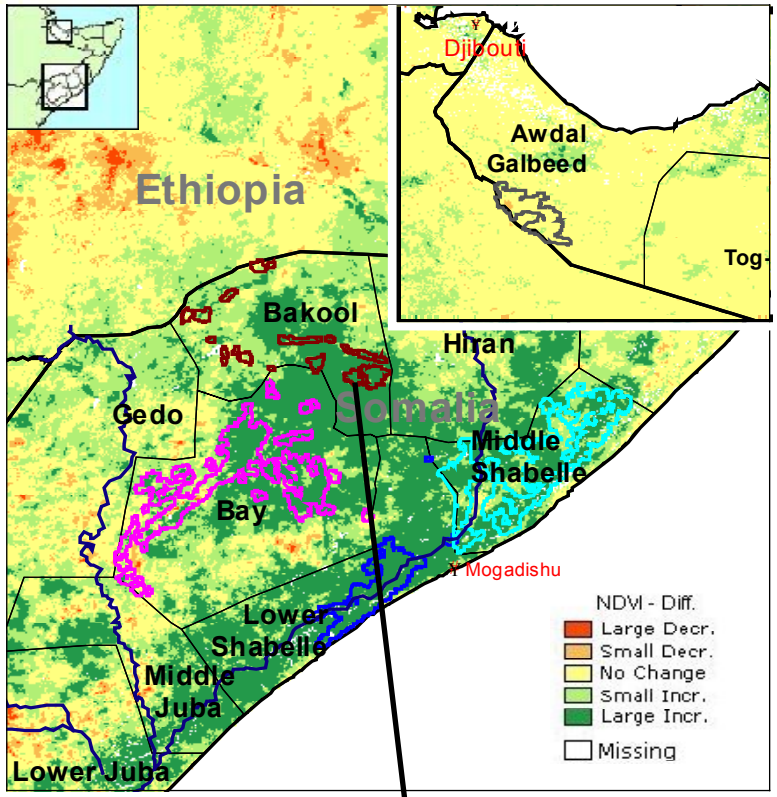
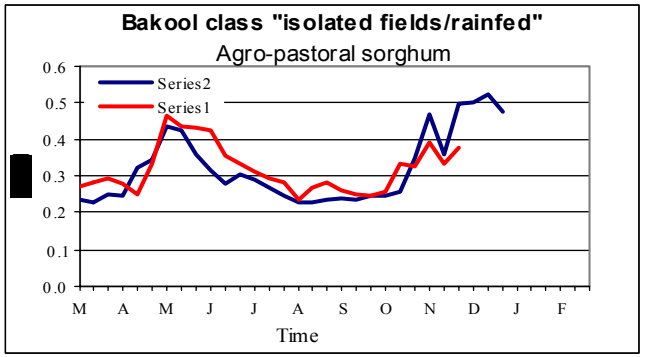
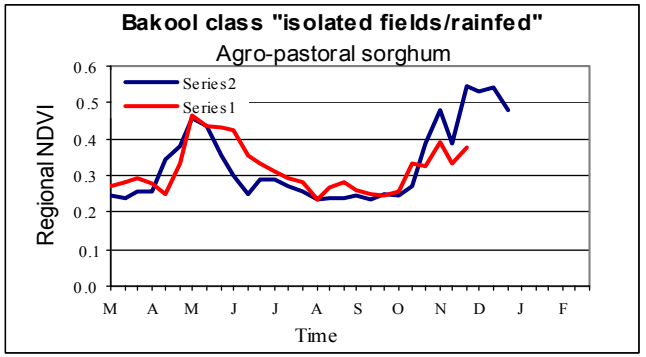
C-NDVI performance - Bakool



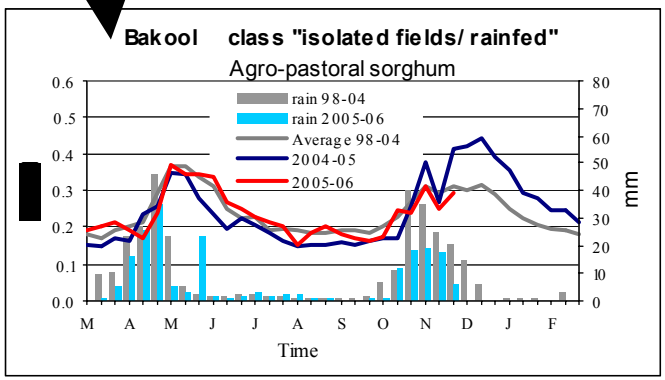
AFRICOVER 1 km NDVI



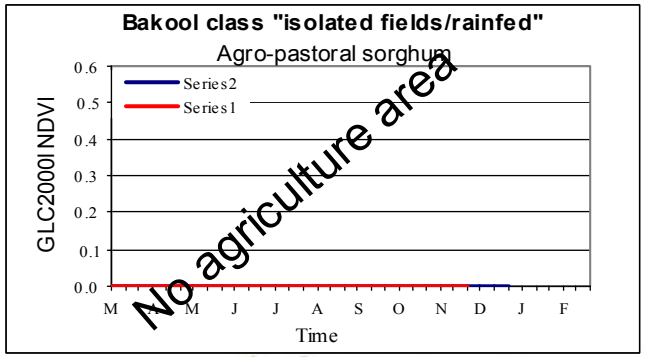
Regional NDVI



AFRICOVER C-NDVI



GLC 2000 NDVI



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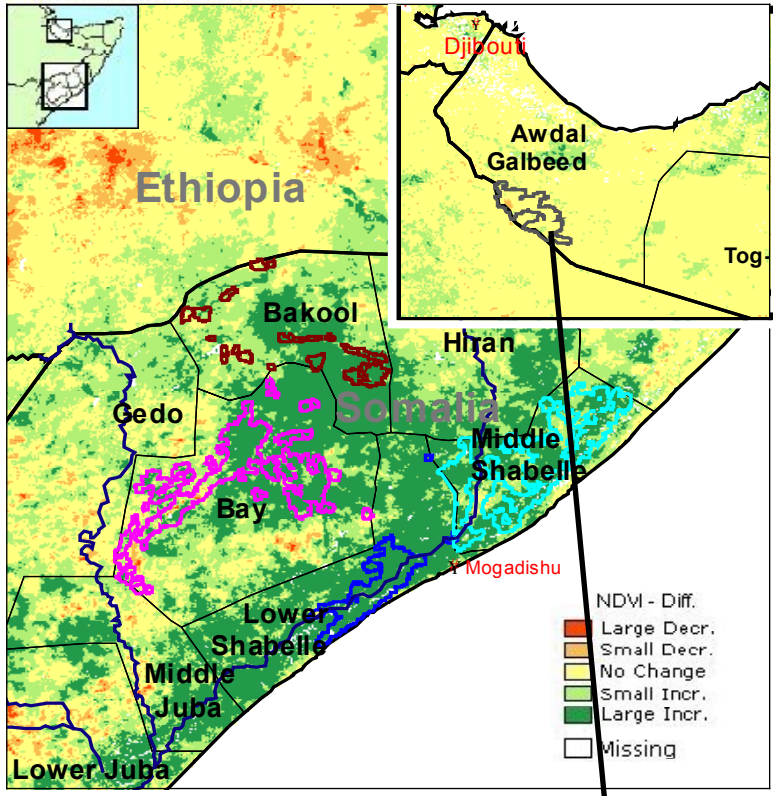
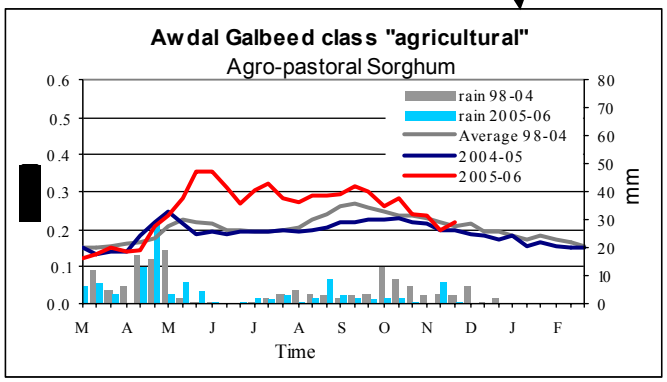
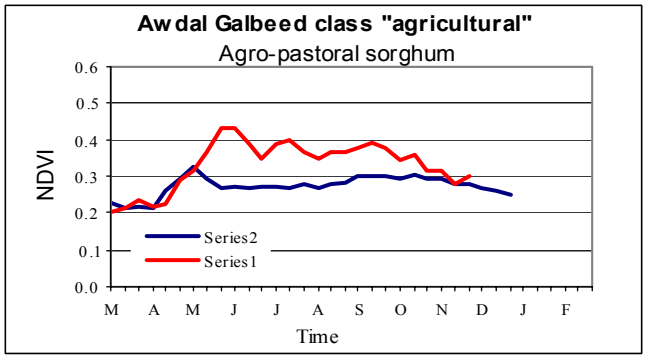
C-NDVI performance – Awdal Galbeed



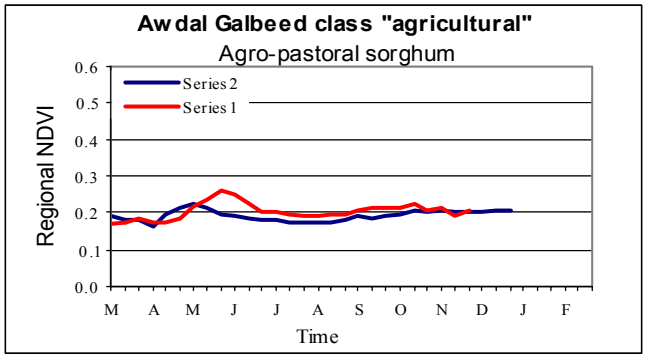
AFRICOVER C-NDVI



AFRICOVER 1 km NDVI



Regional NDVI



Conclusion : no need for high resolution agriculture map but resolution similar to NDVI profile resolution recommended

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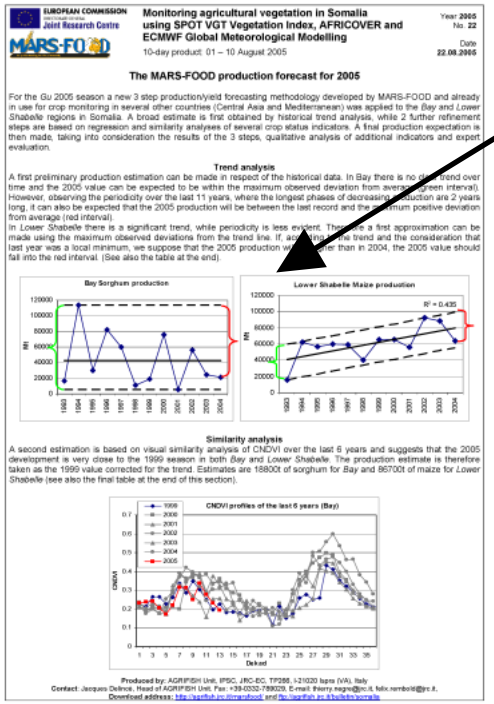
Quantitative approach

Three steps : Trend, Similarity, Regression



Monitoring agricultural vegetation in Somalia using SPOT VGT Vegetation Index, AFRICOVER and ECMWF Global Meteorological Modelling

10-day product: 01 – 10 August 2005

Year 2005 No. 22

Date 22.08.2005

The MARS-FOOD production forecast for 2005

For the Gu 2005 season a new 3 step production/yield forecasting methodology developed by MARS-FOOD and already in use for crop monitoring in several other countries (Central Asia and Mediterranean) was applied to the *Bay* and *Lower Shabelle* regions in Somalia. A broad estimate is first obtained by historical trend analysis, while 2 further refinement steps are based on regression and similarity analyses of several crop status indicators. A final production expectation is then made, taking into consideration the results of the 3 steps, qualitative analysis of additional indicators and expert evaluation.

Trend analysis

A first preliminary production estimation can be made in respect of the historical data. In Bay there is no clear trend over time and the 2005 value can be expected to be within the maximum observed deviation from average (green interval). However, observing the periodicity over the last 11 years, where the longest phases of decreasing production are 2 years long, it can also be expected that the 2005 production will be between the last record and the maximum positive deviation from average (red interval).

In Lower Shabelle there is a significant trend, while periodicity is less evident. Therefore a first approximation can be made using the maximum observed deviations from the trend line. If, additionally, the trend and the consideration that last year was a local minimum, we suppose that the 2005 production will be higher than in 2004, the 2005 value should fall into the red interval. (See also the table at the end).

Bay Sorghum production

Lower Shabelle Maize production

Similarity analysis

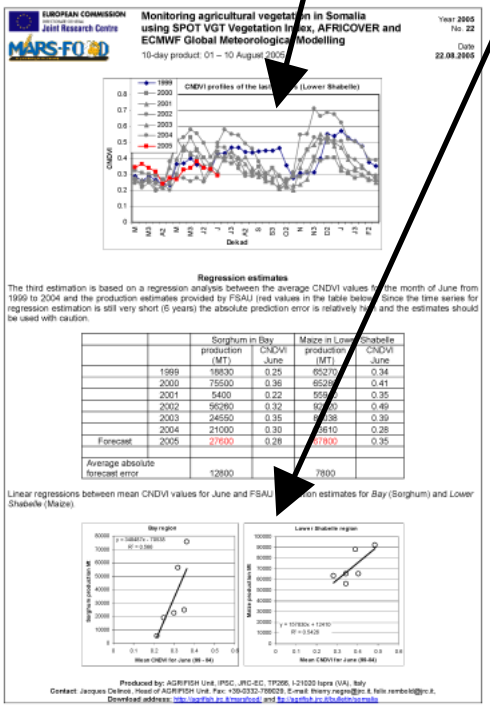
A second estimation is based on visual similarity analysis of CNDVI over the last 6 years and suggests that the 2005 development is very close to the 1999 season in both *Bay* and *Lower Shabelle*. The production estimate is therefore taken as the 1999 value corrected for the trend. Estimates are 18800t of sorghum for *Bay* and 86700t of maize for *Lower Shabelle* (see also the final table at the end of this section).

CNDVI profiles of the last 6 years (Bay)

Produced by: AGRIFISH Unit, IPSC, JRC-EC, TP266, I-21020 Ispra (VA), Italy

Contact: Jacques Delincé, Head of AGRIFISH Unit, Fax: +39-0332-789029, E-mail: thierry.negre@jrc.it, felix.rembold@jrc.it,

Download address: http://agrifish.jrc.it/marsfood/ and ftp://agrifish.jrc.it/bulletins/somalia



Monitoring agricultural vegetation in Somalia using SPOT VGT Vegetation Index, AFRICOVER and ECMWF Global Meteorological Modelling

10-day product: 01 – 10 August 2005

Year 2005 No. 22

Date 22.08.2005

CNDVI profiles of the last 6 years (Lower Shabelle)

Regression estimates

The third estimation is based on a regression analysis between the average CNDVI values for the month of June from 1999 to 2004 and the production estimates provided by FSAU (red values in the table below). Since the time series for regression estimation is still very short (6 years) the absolute prediction error is relatively high and the estimates should be used with caution.

	Sorghum in Bay		Maize in Lower Shabelle	
	production (MT)	CNDVI June	production (MT)	CNDVI June
1999	18830	0.25	66270	0.34
2000	75500	0.36	65280	0.41
2001	5400	0.22	55260	0.35
2002	56260	0.32	92000	0.49
2003	24550	0.35	67038	0.39
2004	21000	0.30	59610	0.28
Forecast 2005	27600	0.28	67800	0.35
Average absolute forecast error	12800		7800	

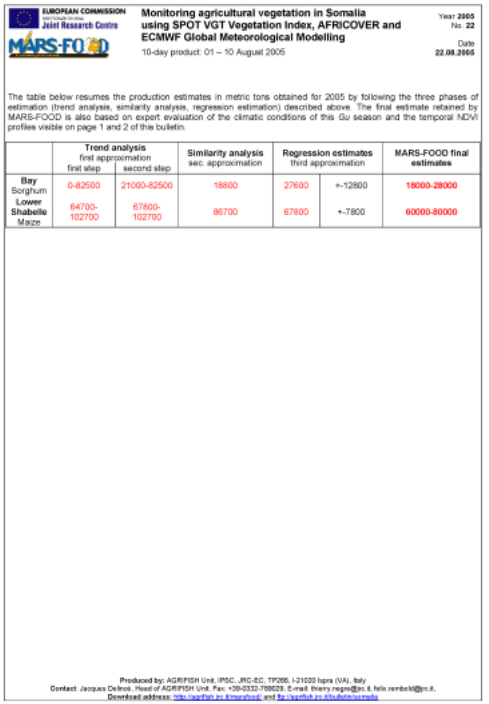
Linear regressions between mean CNDVI values for June and FSAU production estimates for *Bay* (Sorghum) and *Lower Shabelle* (Maize).

Produced by: AGRIFISH Unit, IPSC, JRC-EC, TP266, I-21020 Ispra (VA), Italy

Contact: Jacques Delincé, Head of AGRIFISH Unit, Fax: +39-0332-789029, E-mail: thierry.negre@jrc.it, felix.rembold@jrc.it,

Download address: http://agrifish.jrc.it/marsfood/ and ftp://agrifish.jrc.it/bulletins/somalia

Final expert assessment



Monitoring agricultural vegetation in Somalia using SPOT VGT Vegetation Index, AFRICOVER and ECMWF Global Meteorological Modelling

10-day product: 01 – 10 August 2005

Year 2005 No. 22

Date 22.08.2005

The table below resumes the production estimates in metric tons obtained for 2005 by following the three phases of estimation (trend analysis, similarity analysis, regression estimation) described above. The final estimate retained by MARS-FOOD is also based on expert evaluation of the climatic conditions of this *Gu* season and the temporal NDVI profiles visible on page 1 and 2 of this bulletin.

	Trend analysis first approximation first step	Trend analysis first approximation second step	Similarity analysis sec. approximation	Regression estimates third approximation		MARS-FOOD final estimates
Bay Sorghum	0-82500	21000-82500	18800	27600	+-12800	18000-28000
Lower Shabelle Maize	64700-102700	67800-102700	86700	67800	+-7800	60000-80000

Produced by: AGRIFISH Unit, IPSC, JRC-EC, TP266, I-21020 Ispra (VA), Italy

Contact: Jacques Delincé, Head of AGRIFISH Unit, Fax: +39-0332-789029, E-mail: thierry.negre@jrc.it, felix.rembold@jrc.it,

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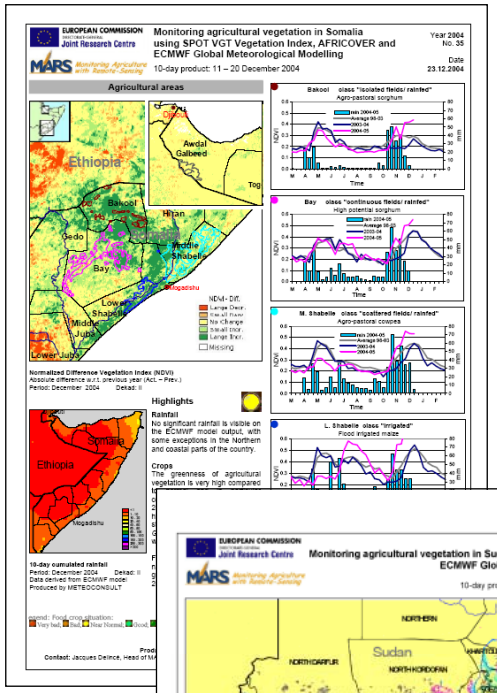
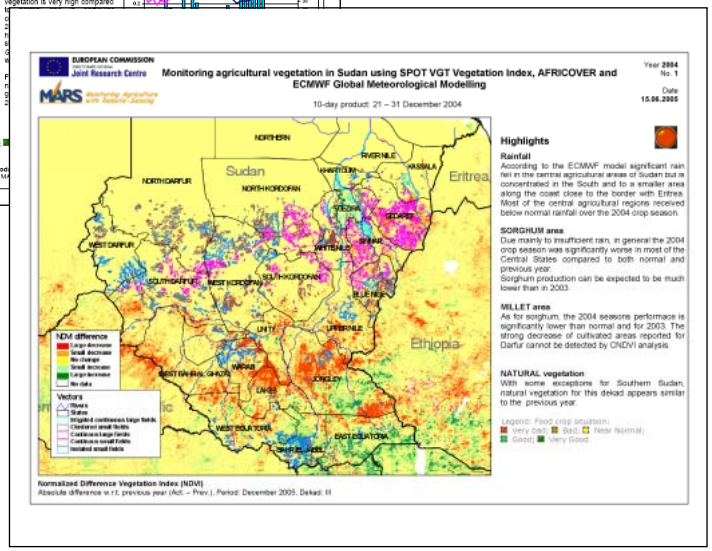
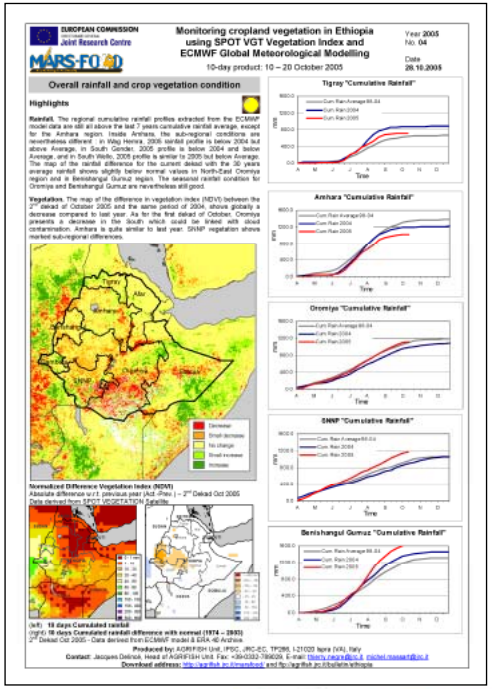
Key information





4 Ten-daily Bulletins : Somalia, Sudan, Ethiopia and Eritrea

Link with local statistics (must be reliable) for the calibration of NDVI / Rainfall information – Support FAO-AGROMAPS & SALB-GAUL initiatives



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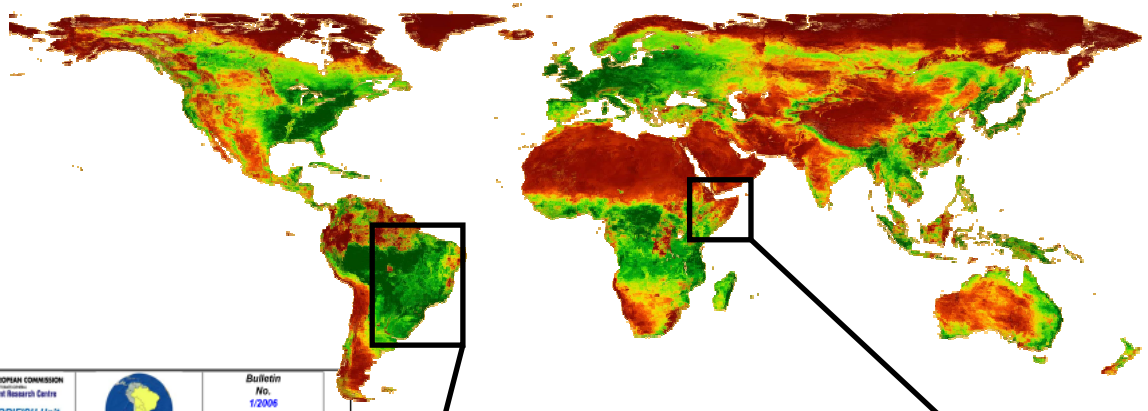
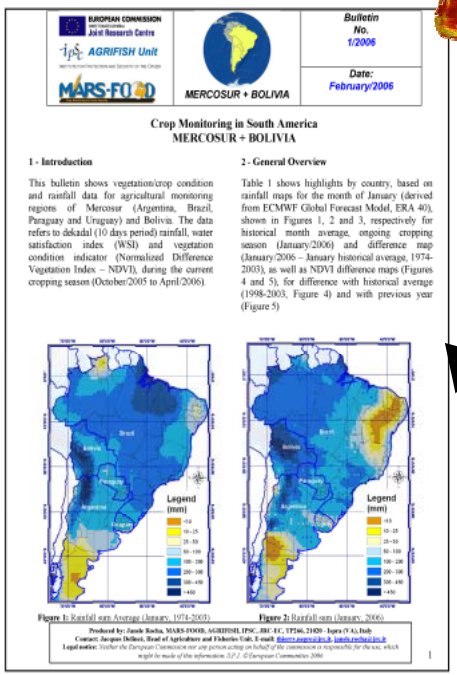
Monthly and Bi-monthly Bulletins, East Africa example





Bulletin No. 1/2006
Date: February/2006
MERCOSUR + BOLIVIA

Crop Monitoring in South America
MERCOSUR + BOLIVIA

1 - Introduction

This bulletin shows vegetation/crop condition and rainfall data for agricultural monitoring regions of Mercosur (Argentina, Brazil, Paraguay and Uruguay) and Bolivia. The data refers to dekadal (10 days period) rainfall, water satisfaction index (WSI) and vegetation condition indicator (Normalized Difference Vegetation Index – NDVI), during the current cropping season (October/2005 to April/2006).

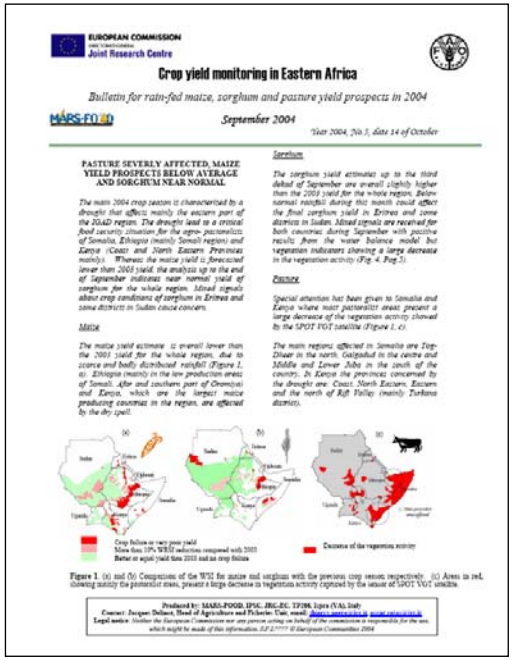
2 - General Overview

Table 1 shows highlights by country, based on rainfall maps for the month of January (derived from ECMWF Global Forecast Model, ERA 40), shown in Figures 1, 2 and 3, respectively for historical month average, ongoing cropping season (January/2006) and difference map (January/2006 – January historical average, 1974-2003), as well as NDVI difference maps (Figures 4 and 5), for difference with historical average (1998-2003, Figure 4) and with previous year (Figure 5)

Legend (mm)

Figure 1: Rainfall sum Average (January, 1974-2003)

Figure 2: Rainfall sum (January, 2006)



Crop yield monitoring in Eastern Africa

Bulletin for rain-fed maize, sorghum and pasture yield prospects in 2004

September 2004

PASTURE SEVERELY AFFECTED, MAIZE YIELD PROSPECTS BELOW AVERAGE AND SORGHUM NEAR NORMAL

Approach based on Water Satisfaction Index and C-NDVI

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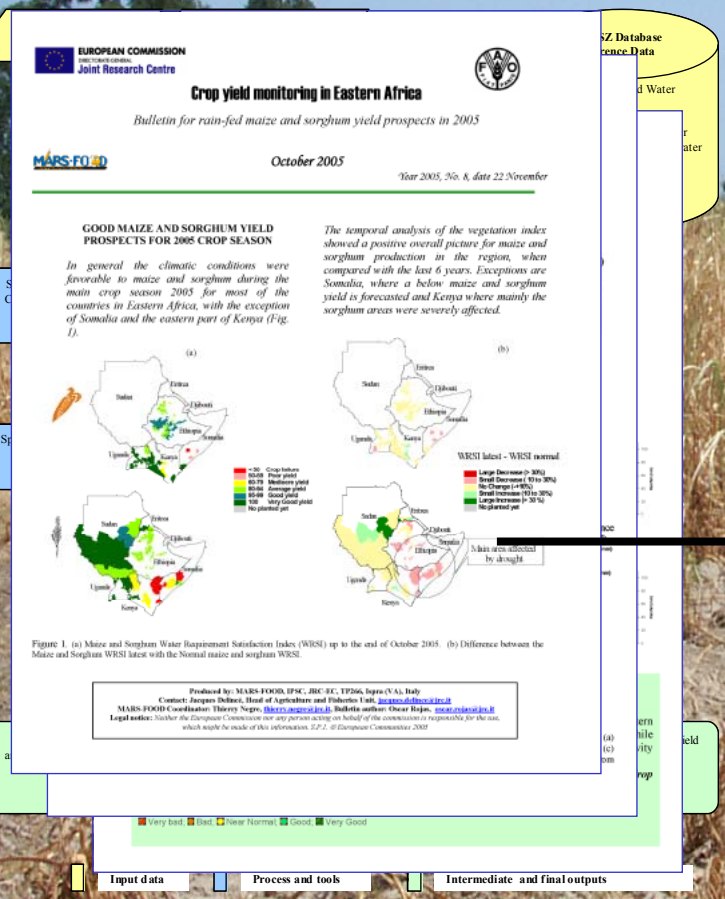
MARS-FOOD Bulletin (East Africa 2005)

Joint Research Centre

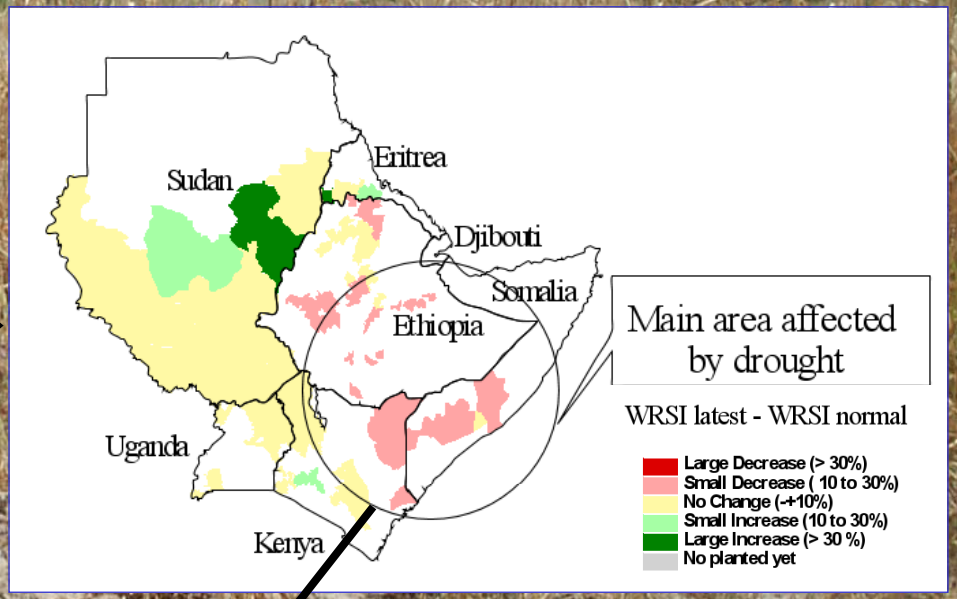
Monthly regional reports
East Africa status 10/2005

Outputs directly usable by food security administrators



Water Satisfaction Index for the Sorghum crop (October 2005)

Difference with Normal WSI of Sorghum (Average of the last 6 years)



2005 : Drop in Sorghum production as compared to normal condition (11 Million people affected)

Key information needed to run the FAO Water Balance Model

- Planting decade – Under improvement : AGHRYMET rainfall rules, NDVI Phenology product of GEOLAND-VGT4AFRICA, …
- Current rainfall by decade – ECMWF model, Must be improved, thru Crop Rangeland Monitoring Network, Rainfall data assessment WG (?) : ECMWF, RFE, …
- Current PET – ECMWF model
- Length of the Crop cycle
- Soil water holding capacity (soil data)

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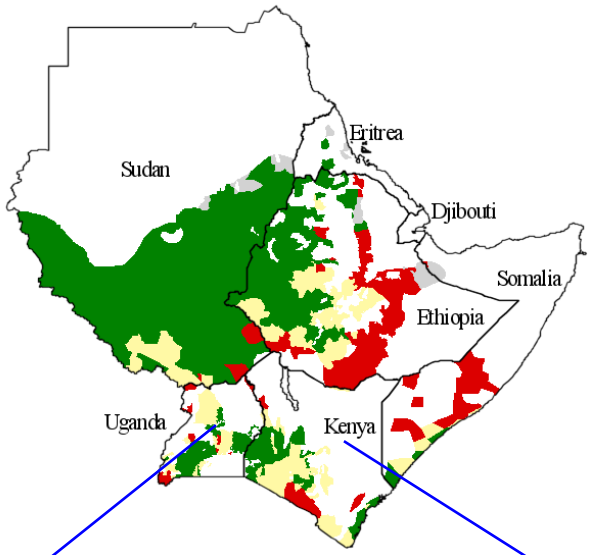
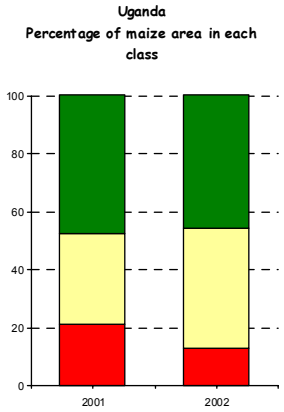
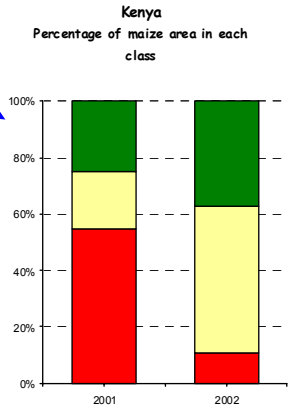
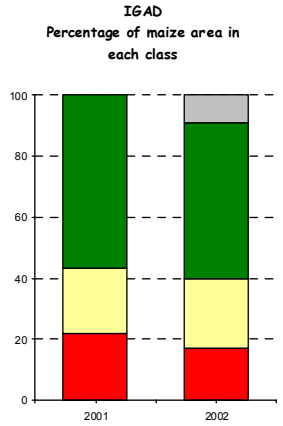
Qualitative crop yield assessment using the WSI

Qualitative crop yield assessment using the Water Satisfaction Index (WSI)









WSI for Maize

< 50	Crop failure
50-79	Poor/Mediocre
80-100	Average /Very Good
	Not planted yet

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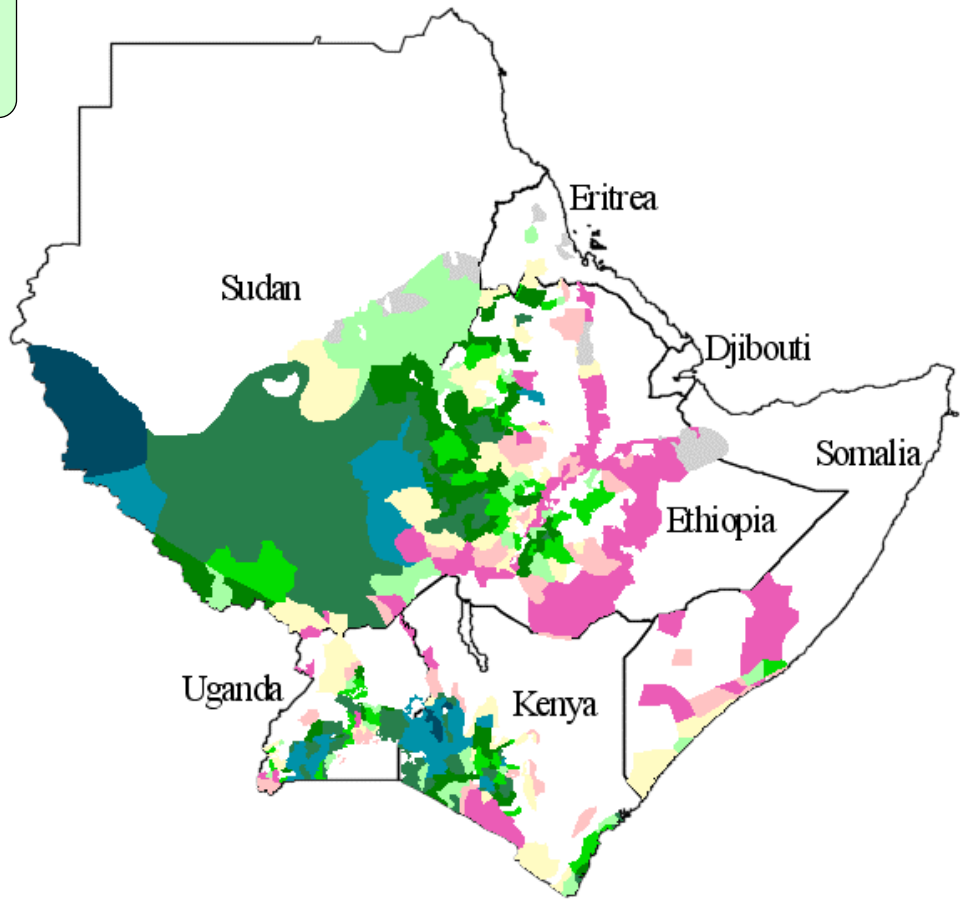
Quantitative crop yield assessment (t/ha)

Quantitative Crop Yield assessment (t/ha)



Maize Yield Estimate

(t/ha)

- < 0.20
- 0.20-0.50
- 0.51-0.80
- 0.81-1.00
- 1.01-1.20
- 1.21 - 1.50
- 1.51 - 2.00
- 2-4
- >4
- No planted yet

Based on years of reference and potential yield, Under Calibration

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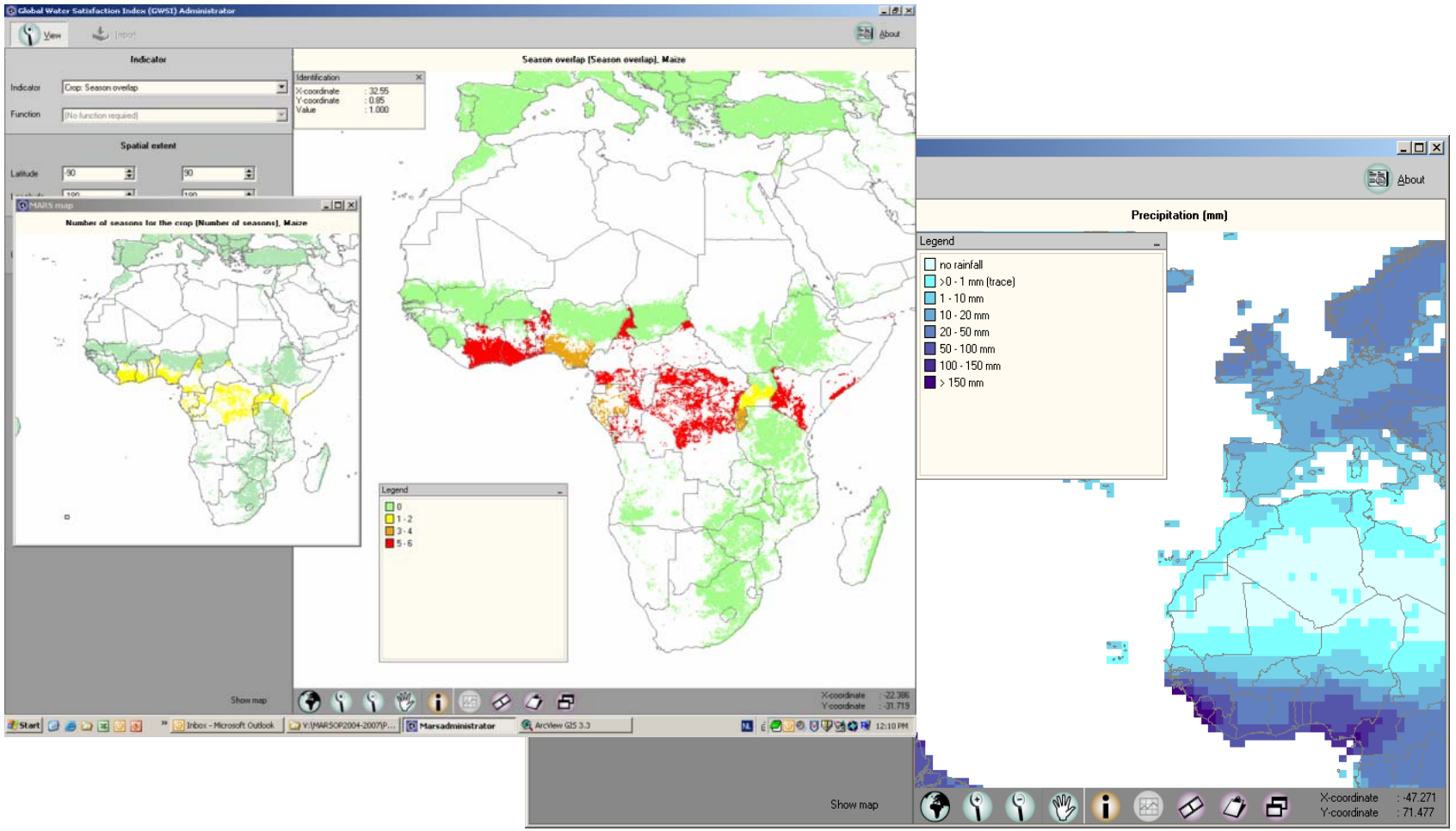
Global Crop Specific Water Balance Model (GCSWB) under implementation / “automatic” version



Under development in collaboration with FAO

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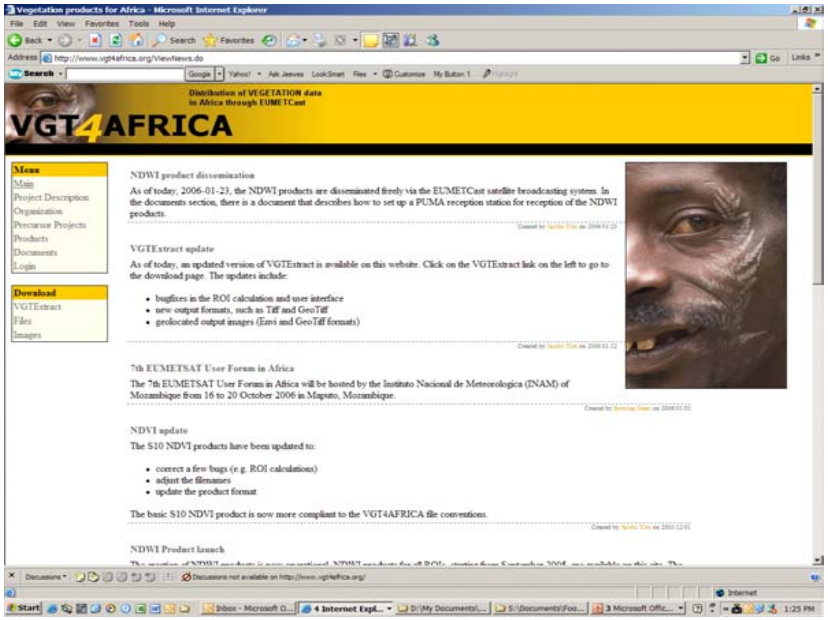
2 Bulletins based on WSI and/or C-NDVI : East Africa and South America

Data dissemination : thru EUMETCAST – VGT4AFRICA and in collaboration with GMFS

Data exchange policy : VGT and ECMWF requests, under discussion



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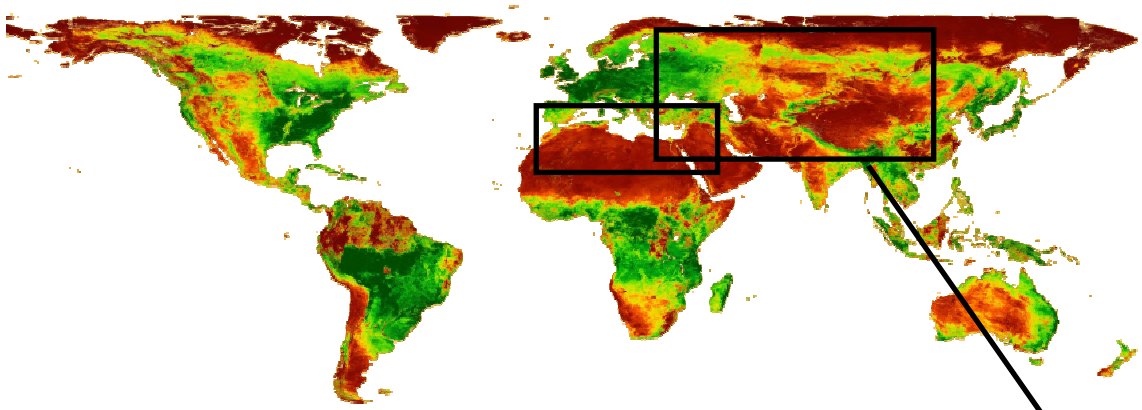
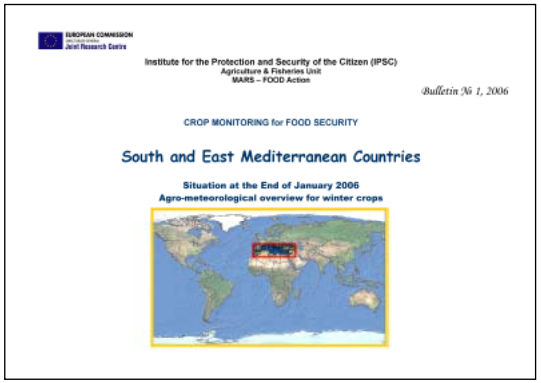
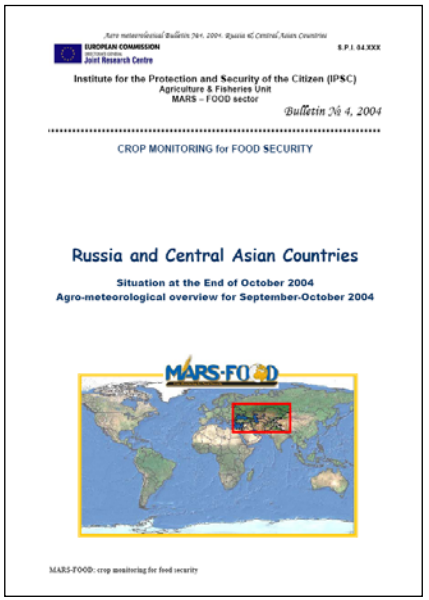
Monthly & Bi-monthly Bulletins, Russia and Central Asia example







Approach based on CGMS* and C-NDVI

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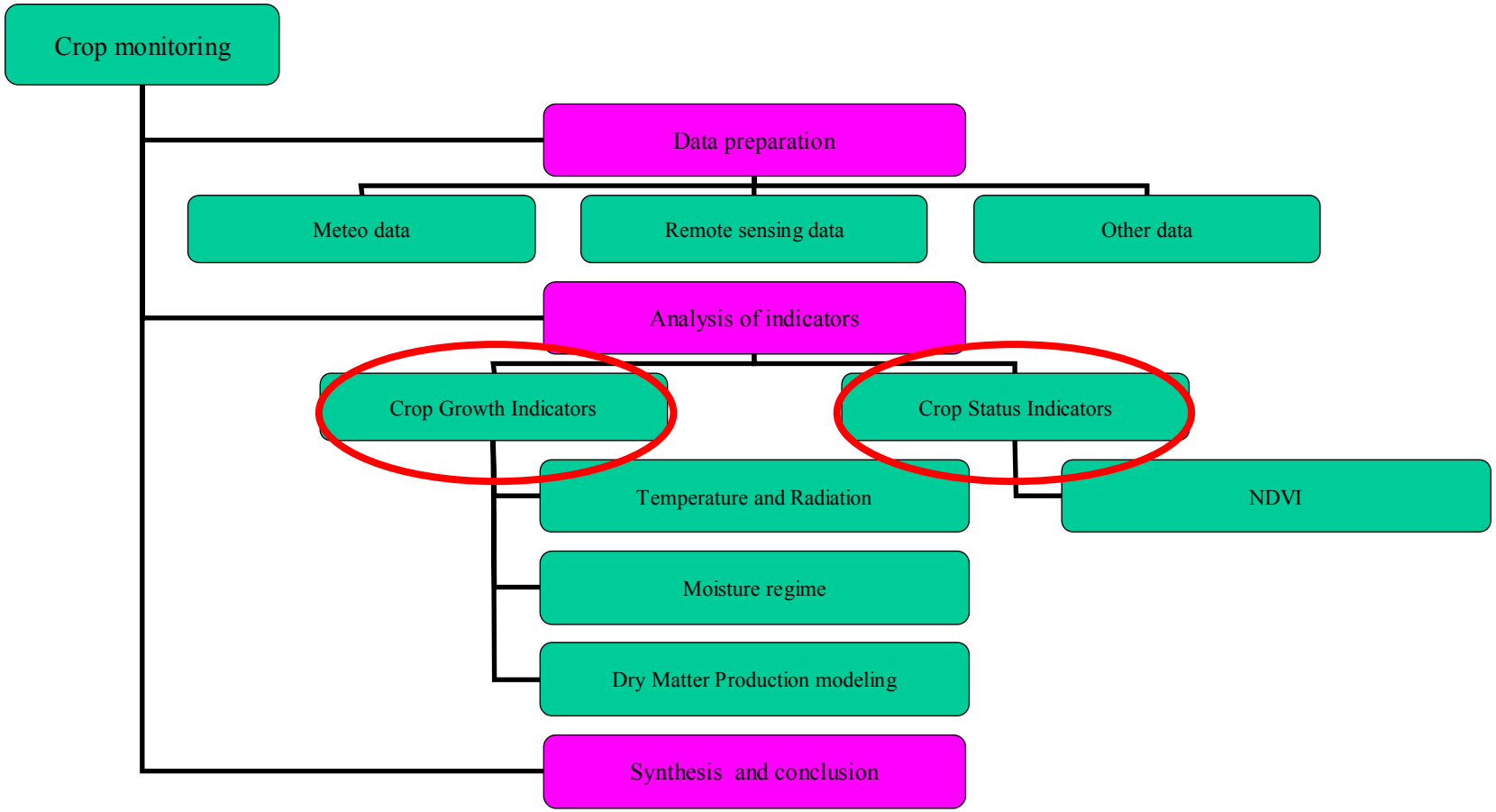
Current Russia and Central Asia Bulletin structure



Qualitative approach based on indicators before an operational CGMS under calibration

Two families of indicators (Crop Growth – Meteo and Crop Status – NDVI-DMP)

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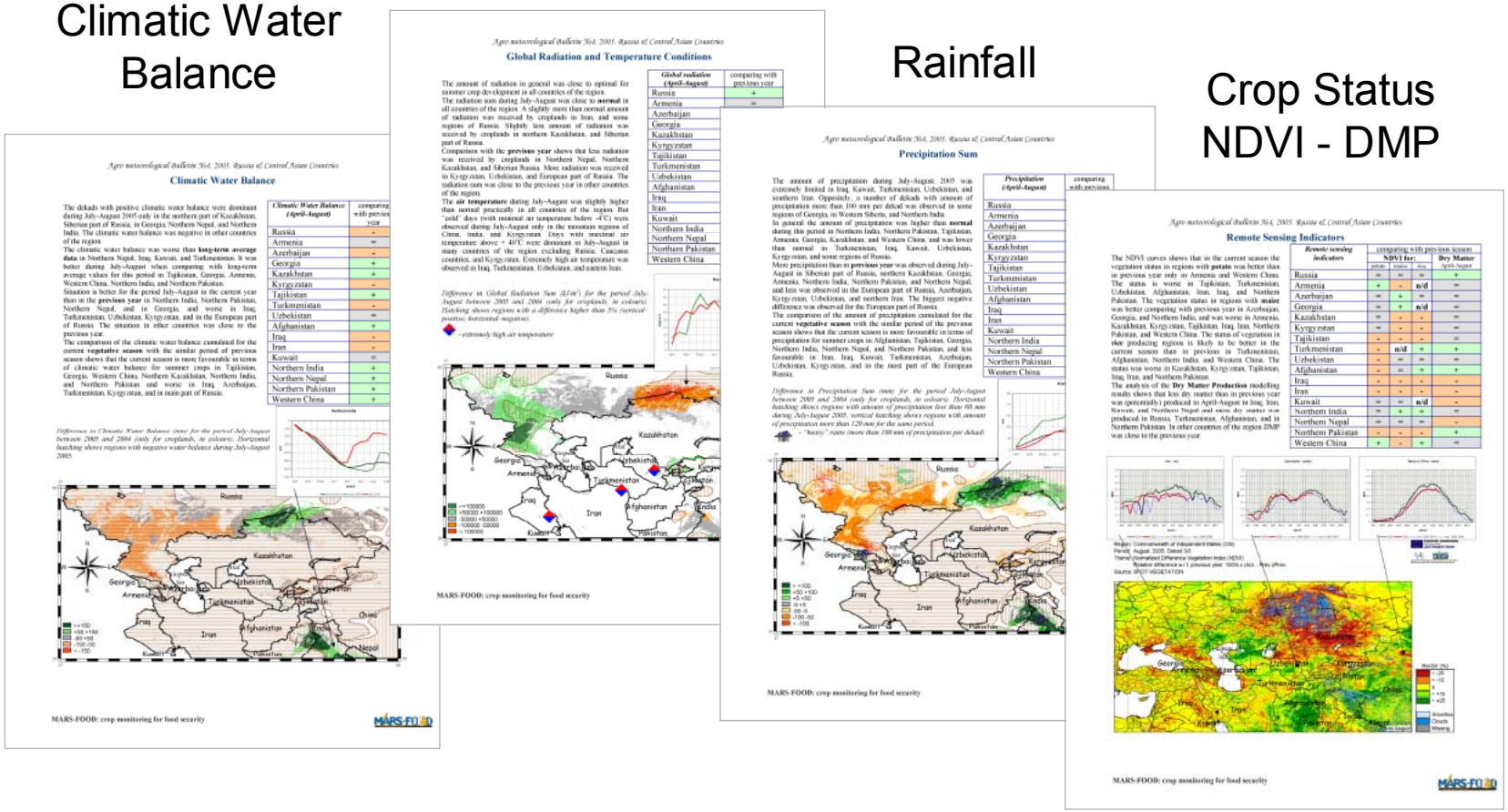
Indicators (extract from main bulletin pages)

Radiation and Temperature

Climatic Water Balance

Rainfall

Crop Status NDVI - DMP



Current indicators compared with last year and 15 years average

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Yield forecast (extract from bulletin pages)

Expert GIS based mapping analysis

Agro meteorological Bulletin №4, 2005. Russia & Central Asian Countries

Results of the analysis

The meteorological conditions during July-August 2005 were favourable or close to optimal for summer crop growth in most countries of the region. Insufficient amounts of precipitation were received only in near Caspian, and Urals regions of Russia, in Iraq, Kuwait, Turkmenistan, Uzbekistan, and southern Kazakhstan. Heavy rains which took place during the period of analysis in some regions of Georgia, Northern Nepal, Northern India, Northern Pakistan, and Northern Kazakhstan should negatively affect summer crop growth. Extremely high air temperature and moisture deficit could damage summer crops in southern Iraq, Turkmenistan, Uzbekistan, and southern Iran.

In general the meteorological situation for summer crops during July-August 2005 was better than in the previous year in the Siberian part of Russia, Georgia, Western China, Northern Kazakhstan, Northern India, Northern Pakistan, and Northern Nepal, and was worse in the other countries of the region.

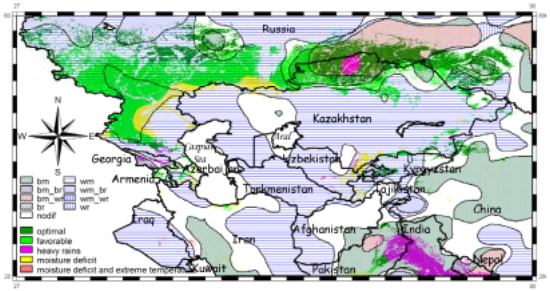
The summer crop status at the end of August 2005 is likely to be better than last year in Northern India, and Western China and worse in Kyrgyzstan, Tajikistan, Iraq, Iran, and Northern Pakistan.

The summer crops yield expectations are presented in the table. These values are preliminary, and should be used with caution.

Yield Expectation for 2005 (t/ha)	crop		
	maize	rice	potato
Russia	2,5-3,2	3,3-3,8	10,1-11,5
Armenia	4,3-6,2	No crop	11,6-16,1
Azerbaijan	3,6-4,7	5,0-5,8	11,1-14,2
Georgia	1,7-2,5	No crop	10,4-13,4
Kazakhstan	2,5-3,9	2,8-3,3	11,1-14,7
Kyrgyzstan	5,0-6,1	3,7-4,3	12,1-17,4
Tajikistan	5,2-6,2	3,5-4,5	13,0-16,0
Turkmenistan	0,6-1,0	1,0-2,0	4,2-6,1
Uzbekistan	4,3-4,9	3,3-4,7	13,6-16,6
Afghanistan	No data	No data	No data
Iraq	No data	No data	No data
Iran	6,0-8,0	4,5-5,5	19,1-22,0
Kuwait	19,0-21,0	No crop	28,0-35,0
Northern India	No data	No data	No data
Northern Nepal	No data	No data	No data
Northern Pakistan	No data	No data	No data
Western China	No data	No data	No data

Green colour indicates figures which are higher than normal, red colour indicates figures which are lower than normal, and black – close to normal.

Favourability of meteorological conditions during July-August 2005 for summer crops (in color):
color on the map shows favorability and main limitations (see legend on the left)
Comparison with the conditions of previous year:
hatchings show units, where: **br** *– better radiation regime;* **bm** *– better moisture regime;* **wr** *– worse radiation regime;* **wm** *– worse moisture regime*



MARS-FOOD: crop monitoring for food security

Quantitative / Regression approach

Agro meteorological Bulletin №4, 2005. Russia & Central Asian Countries

Yield Prediction

The yield 2005 figures were received based on simultaneous analysis of statistical yield data, and different crop growth indicators. The methodological approach is briefly described on the next page of the Bulletin. The table below contains the results of the analysis.

Use of the main crop growth indicators for yield prediction at the end of August 2005.

country	*crop*	*crop growth indicator & yield expectation based on its analysis (t/ha)*									*Yield expectation for 2005 (t/ha)*
		Analysis of the statistical yield curve	Linear regression with cumulated DMP values since April 2005		Linear regression with Maximal NDVI value		Year-analogue for NDVI profile		Year-analogue for Cumulated for the season Dry Matter production profile		
		yield	yield	R^2	yield	R^2	year	yield	year	yield	
Russia	Rice	3,1-3,8	-	-	-	-	2000	3,5	2000	3,5	**3,3-3,8**
	Maize	2,5-4,0	-	-	-	-	2002	2,9	2000	2,1	**2,5-3,2**
	Potato	10,1-11,5	-	-	-	-	2004	11,5	2001	10,9	**10,1-11,5**
Armenia	Maize	4,3-6,2	4,1	0,422	-	-	2000	2,3	2004	6,2	**4,3-6,2**
	Potato	11,6-16,1	14,5	0,505	-	-	1999	13,0	2004	16,1	**11,6-16,1**
Azerbaijan	Rice	5,4-7,4	4,2	0,582	5,0	0,711	2000	5,0	1999	4,5	**5,0-5,8**
	Maize	3,9-5,3	4,0	0,491	4,0	0,885	2002	4,3	2002	4,3	**3,6-4,7**
	Potato	12,3-14,2	-	-	12,9	0,661	1999	10,4	1999	10,4	**11,1-14,2**
Georgia	Maize	1,4-2,8	1,9	0,697	2,3	0,939	2004	2,2	2004	2,2	**1,7-2,5**
	Potato	7,3-14,1	12,2	0,465	11,7	0,815	2003	11,6	2001	11,6	**10,4-13,4**
Kazakhstan	Rice	2,8-3,8	-	-	-	-	1999	2,8	2001	2,9	**2,8-3,3**
	Maize	2,0-3,9	-	-	-	-	1998	2,7	2001	3,7	**2,5-3,9**
	Potato	12,3-16,5	-	-	-	-	1998	7,7	2001	13,3	**11,1-14,7**
Kyrgyzstan	Rice	4,1-4,6	3,9	0,337	-	-	1999	2,5	2001	3,0	**3,7-4,3**
	Maize	5,0-7,1	6,1	0,690	5,8	0,424	1998	4,9	2000	5,8	**5,0-6,1**
	Potato	11,5-17,6	16,4	0,658	-	-	1998	13,1	2001	15,8	**12,1-17,4**
Tajikistan	Rice	4,0-5,4	-	-	2,5	0,755	1999	2,7	1999	2,7	**3,5-4,5**
	Maize	5,7-8,5	-	-	3,2	0,778	1999	3,0	1999	3,0	**5,2-6,2**
	Potato	14,5-22,9	-	-	-	-	1998	10,5	1999	11,7	**13,0-16,0**
Turkmenistan	Rice	0,6-2,5	1,5	0,461	-	-	1999	1,1	2002	1,9	**1,0-2,0**
	Maize	0,5-1,1	-	-	-	-	1999	0,8	2002	0,8	**0,6-1,0**
	Potato	3,0-7,9	-	-	-	-	1999	5,6	2002	4,7	**4,2-6,1**
Uzbekistan	Rice	3,3-4,7	3,4	0,703	2,4	0,694	2003	2,5	2004	4,7	**3,3-4,7**
	Maize	4,5-5,1	4,6	0,505	-	-	1999	3,0	2000	2,7	**4,3-4,9**
	Potato	15,5-18,7	15,5	0,379	13,8	0,824	1999	13,6	2004	16,6	**13,6-16,6**
Afghanistan	Rice	no data	-	-	-	-	1999	no data	2004	no data	-
	Maize	no data	-	-	-	-	2002	no data		no data	-
	Potato	no data	-	-	-	-	1999	no data		no data	-
Iraq	Rice	no data	-	-	-	-	2003	no data	1999	no data	-
	Maize	no data	-	-	-	-	2003	no data	1999	no data	-
	Potato	no data	-	-	-	-	2004	no data	1999	no data	-
Iran	Rice	5,0-6,4	5,2	0,964	4,1	0,761	1999	4,0	1999	4,0	**4,5-5,5**
	Maize	5,5-9,8	7,2	0,872	6,3	0,401	1999	6,2	1999	6,2	**6,0-8,0**
	Potato	19,1-25,5	19,5	0,949	-	-	1999	10,9	1999	20,9	**19,1-22,0**
Kuwait	Maize	19,0-22,0	-	-	-	-	2003	20,0	1999	19,4	**19,0-21,0**
	Potato	28,0-42,0	-	-	-	-	2004	28,0	1999	27,2	**28,0-35,0**

MARS-FOOD: crop monitoring for food security

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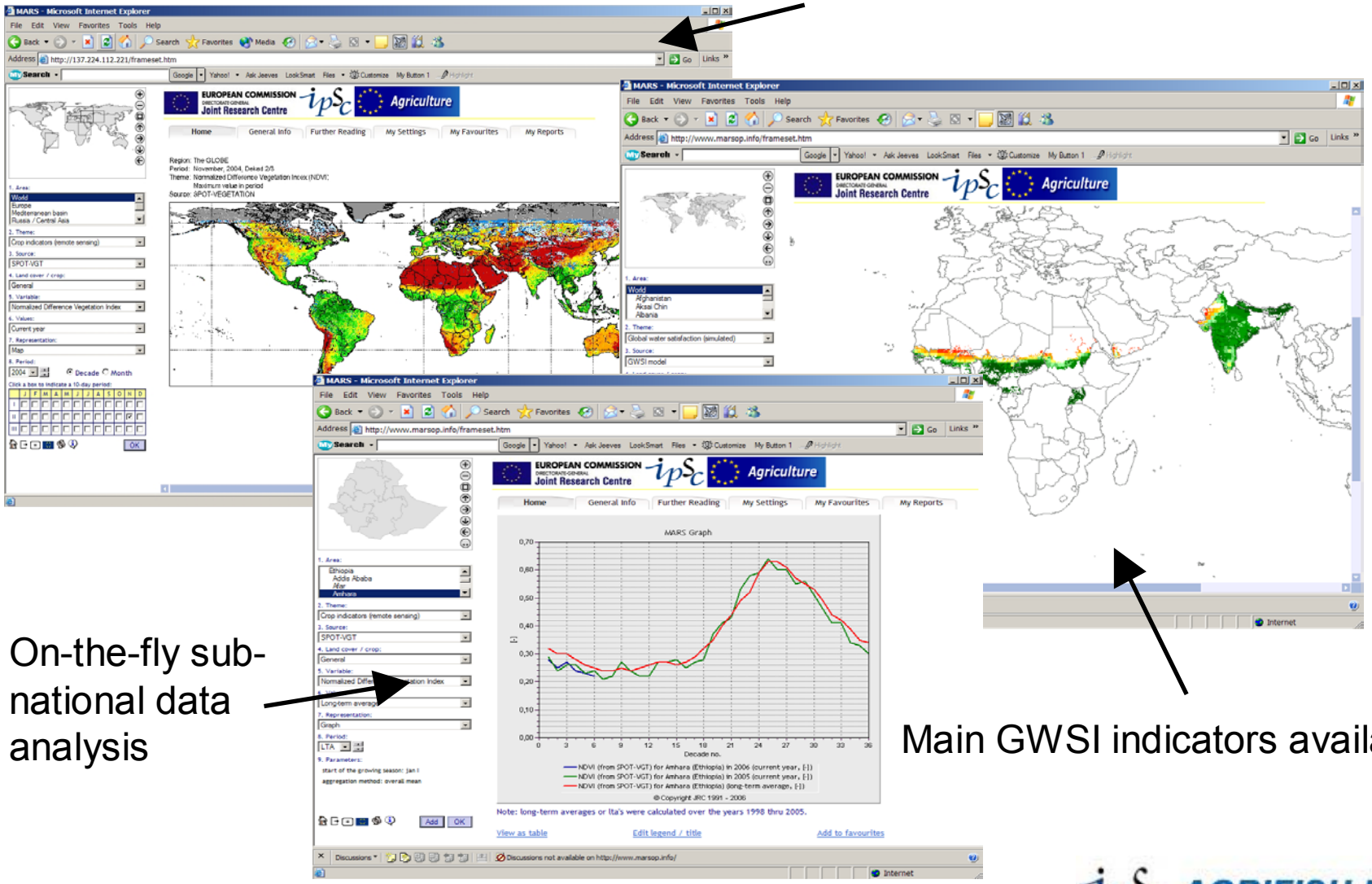
MARSOP Site for information dissemination

Main METEO and satellite base indicators



On-the-fly sub-national data analysis

Main GWSI indicators available

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MARS-FOOD Pool of Expertise

- Support to national / regional institutions capacity building (training, information exchange, …)

- FAO Collaboration Agreement

- Participation in United-Nations FAO - WFP Crop and Food Supply Assessment Missions

- Coordination role for the EU : European Space Agency (GMFS), World Food Program (Emergency Needs Assessment) , …

- Scientific Networks (CRAM, South America) and Regional conferences

- Technical support to EU Delegation under the newly signed Administrative Arrangement with DG AIDCO

- Support to Vulnerability and need assessment

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Crop Monitoring in South America

Jansle Rocha

MARS-FOOD Action / AGRIFISH Unit

Institute for Protection and Security of the Citizen

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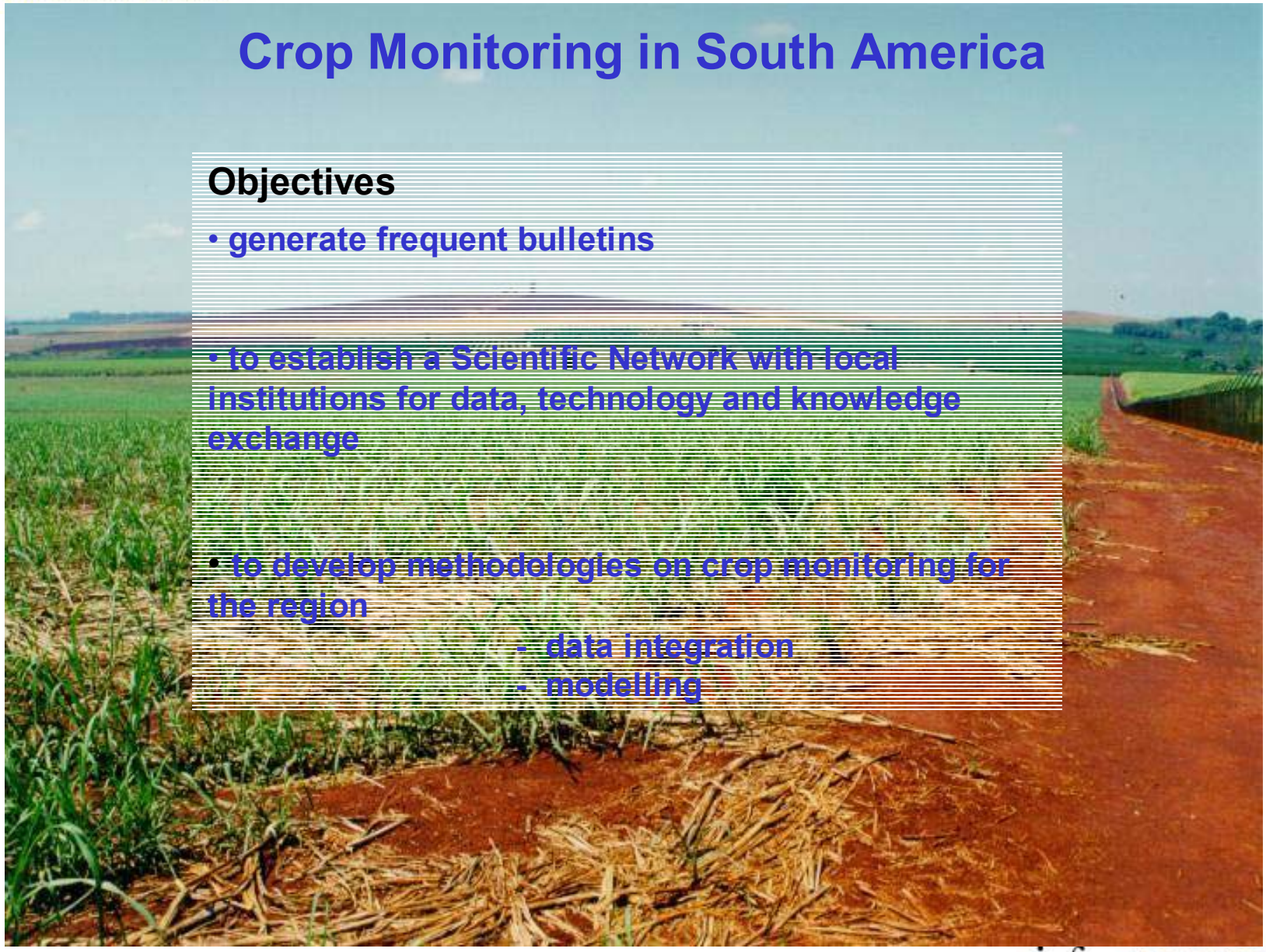
Crop Monitoring in South America



Objectives

- generate frequent bulletins

- to establish a Scientific Network with local Institutions for data, technology and knowledge exchange

- to develop methodologies on crop monitoring for the region
  - data integration
  - modelling

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CROP MONITORING IN SOUTH AMERICA

Bulletins

(http://agrifish.jrc.it/marsfood/Bulletins/southamerica)

- NDVI and Rain (actual, differences and profiles)
- + WSI difference for wheat, maize and soybean
- +cumulated rainfall (from oct/1 or apr/1) + WSI difference for soybean and maize (summer crops) and wheat and maize (winter crops)
- + Mask for Annual Crops (summer) + planting dates (?)

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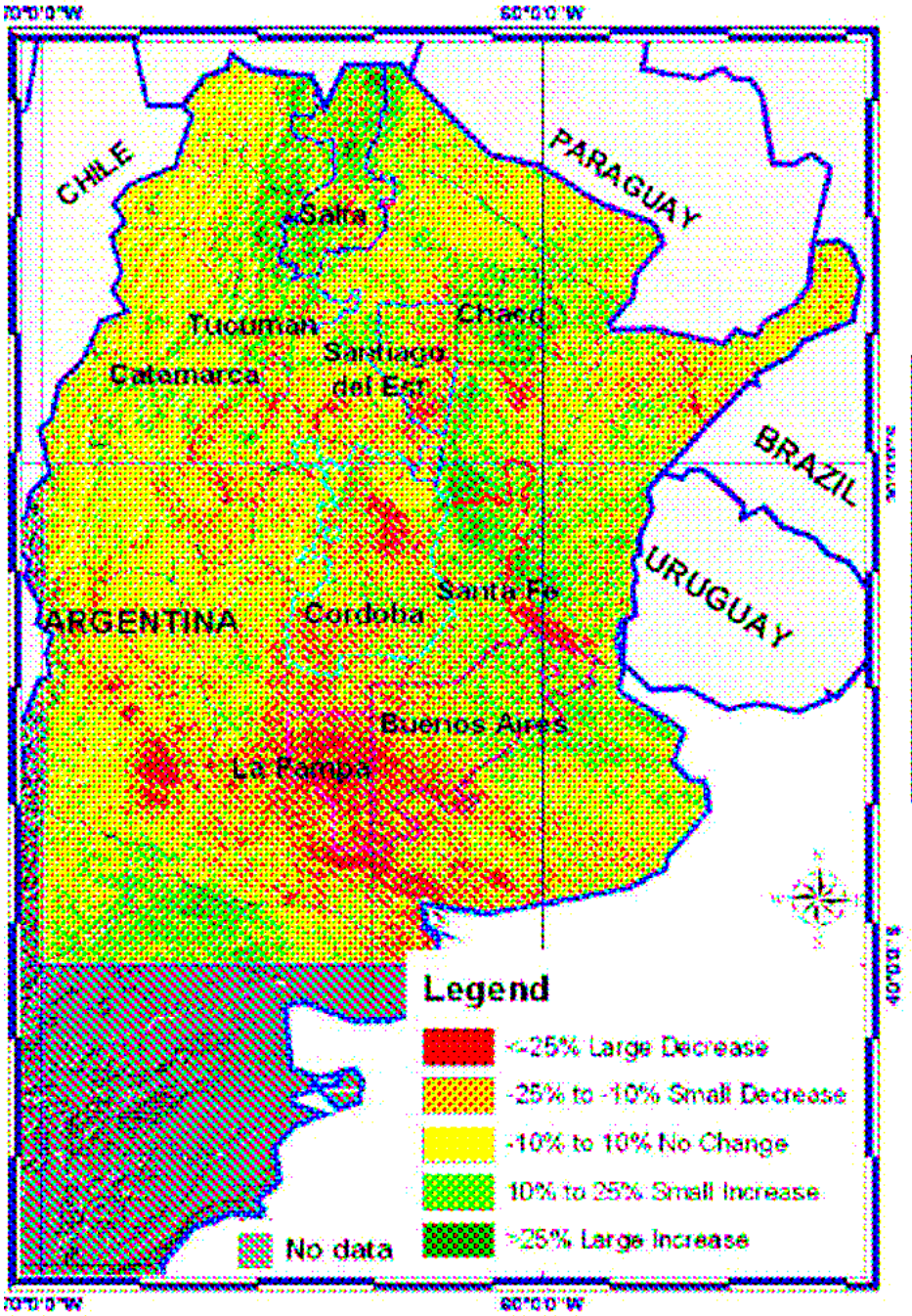
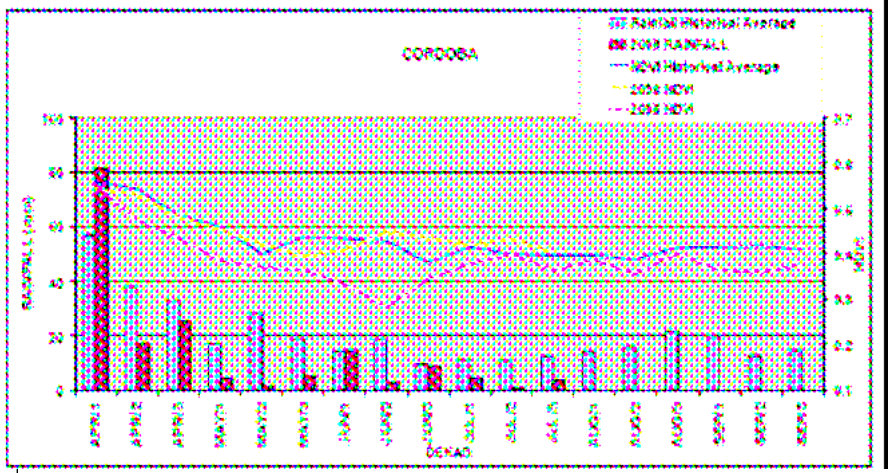
Monitoring Regions - Argentina





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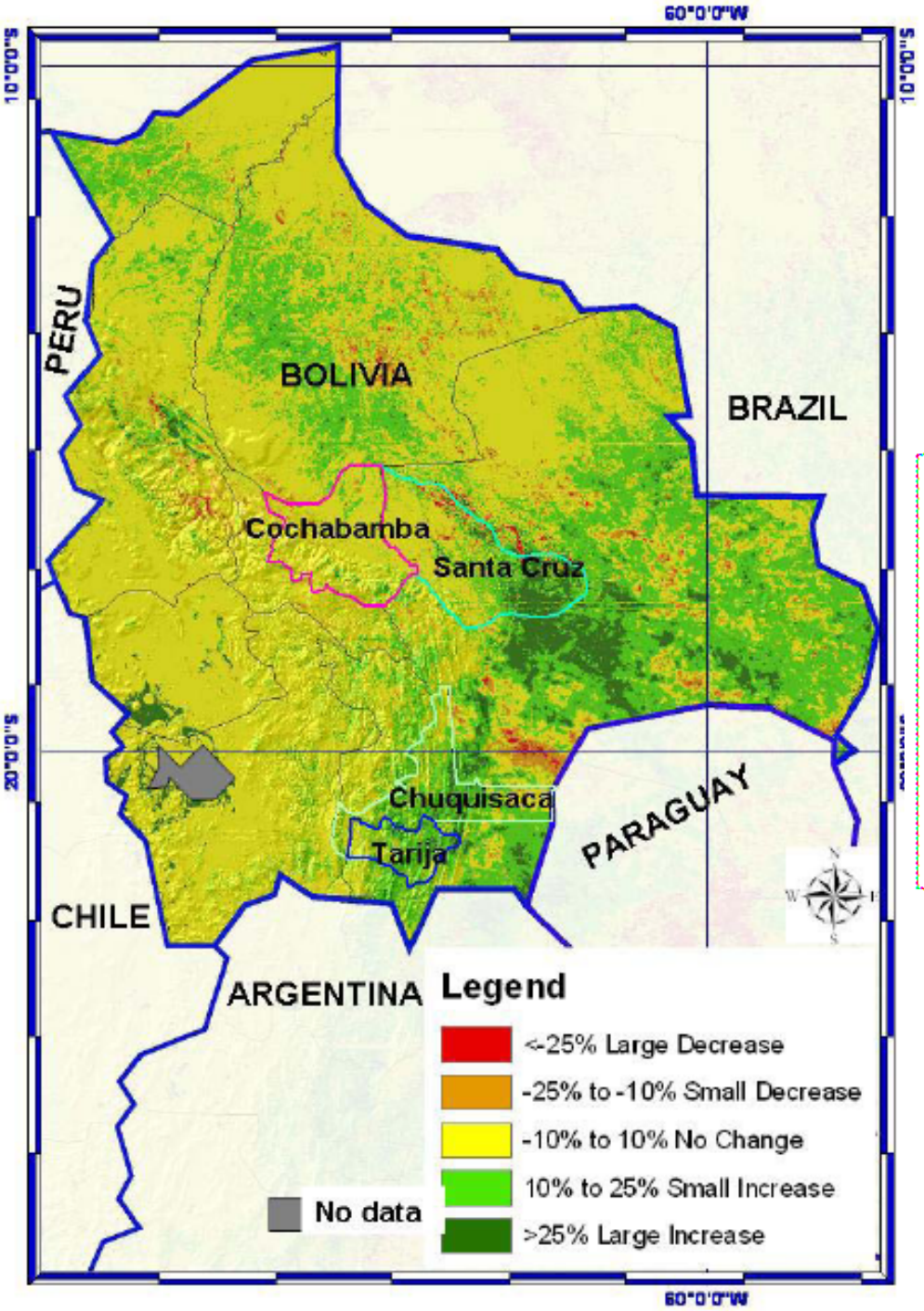
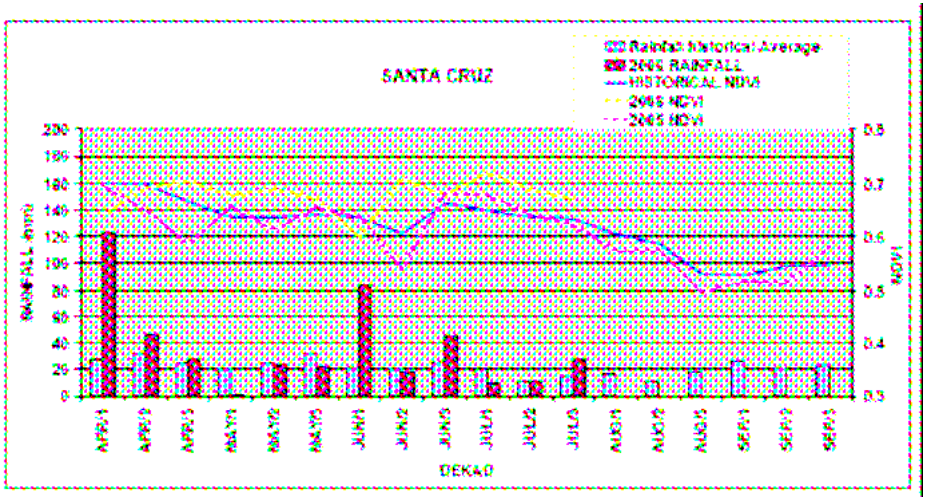
Monitoring Regions - Bolivia





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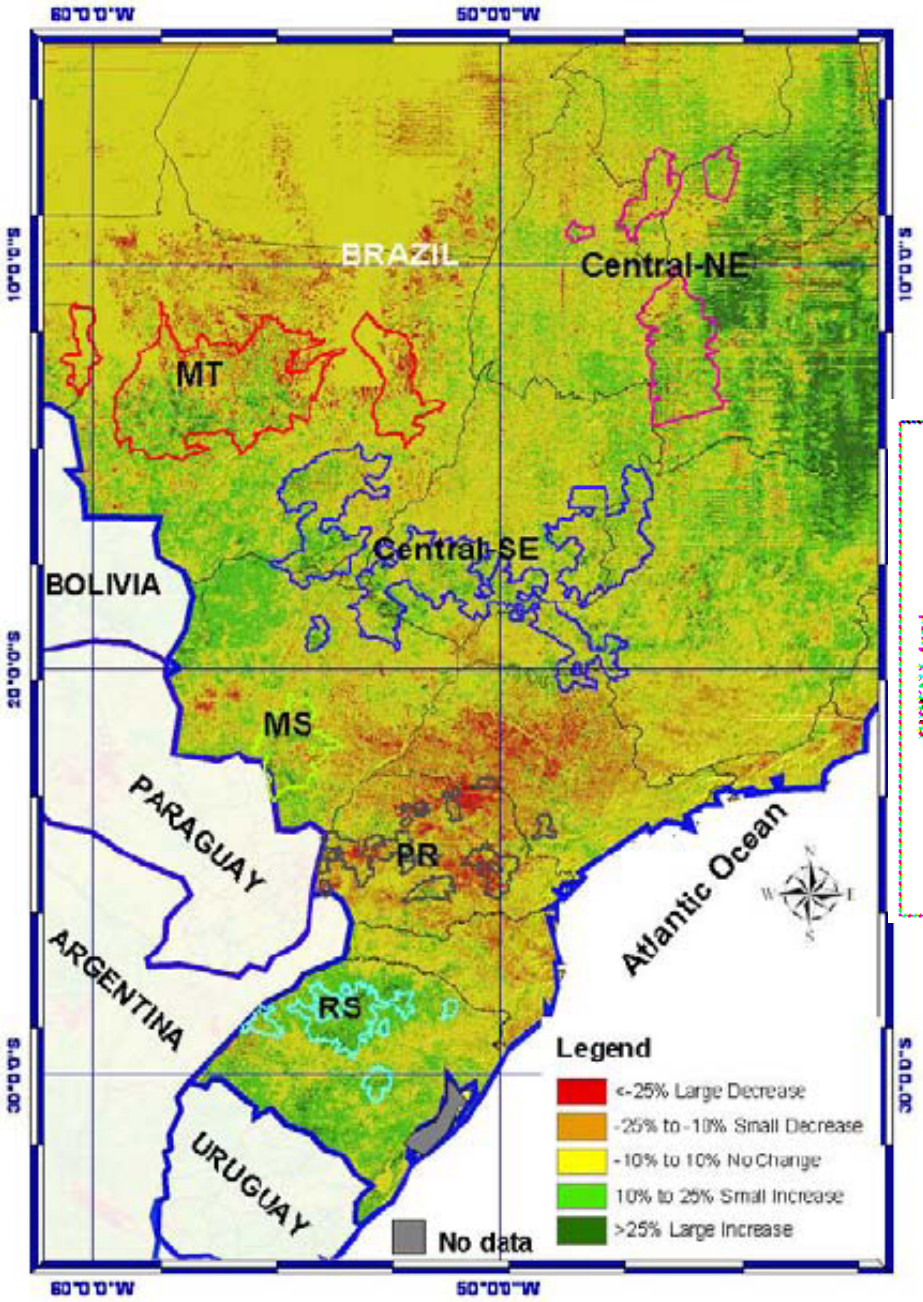
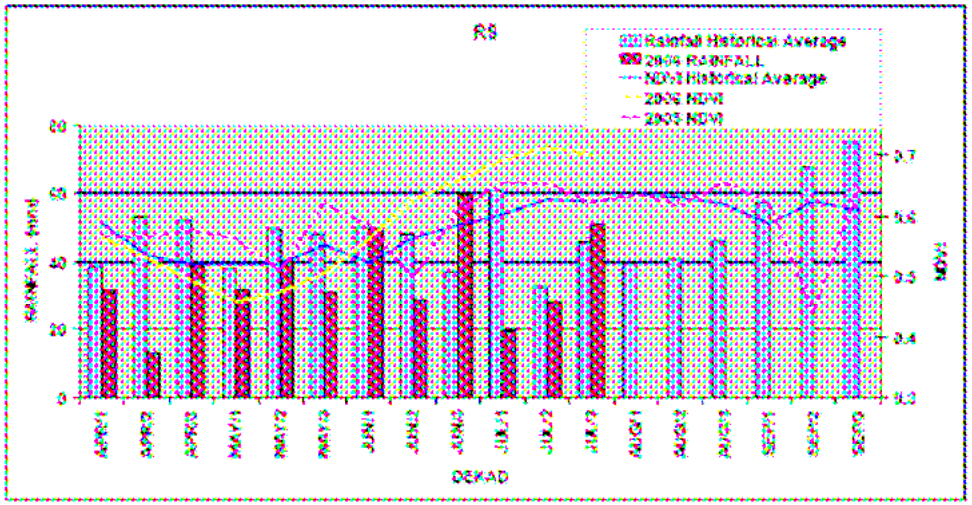
Monitoring Regions - Brasil





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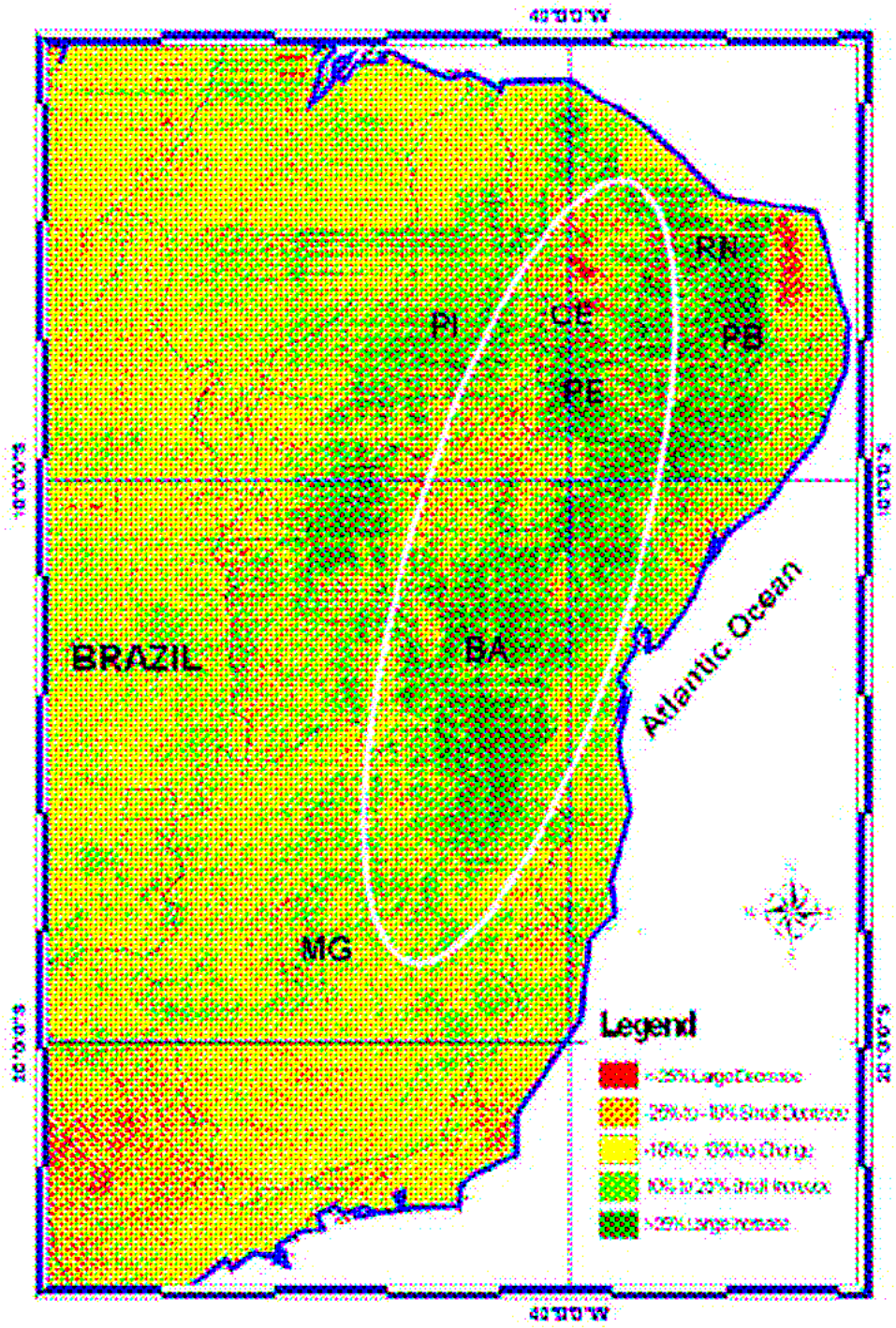

Monitoring Regions – Brasil

food insecurity areas

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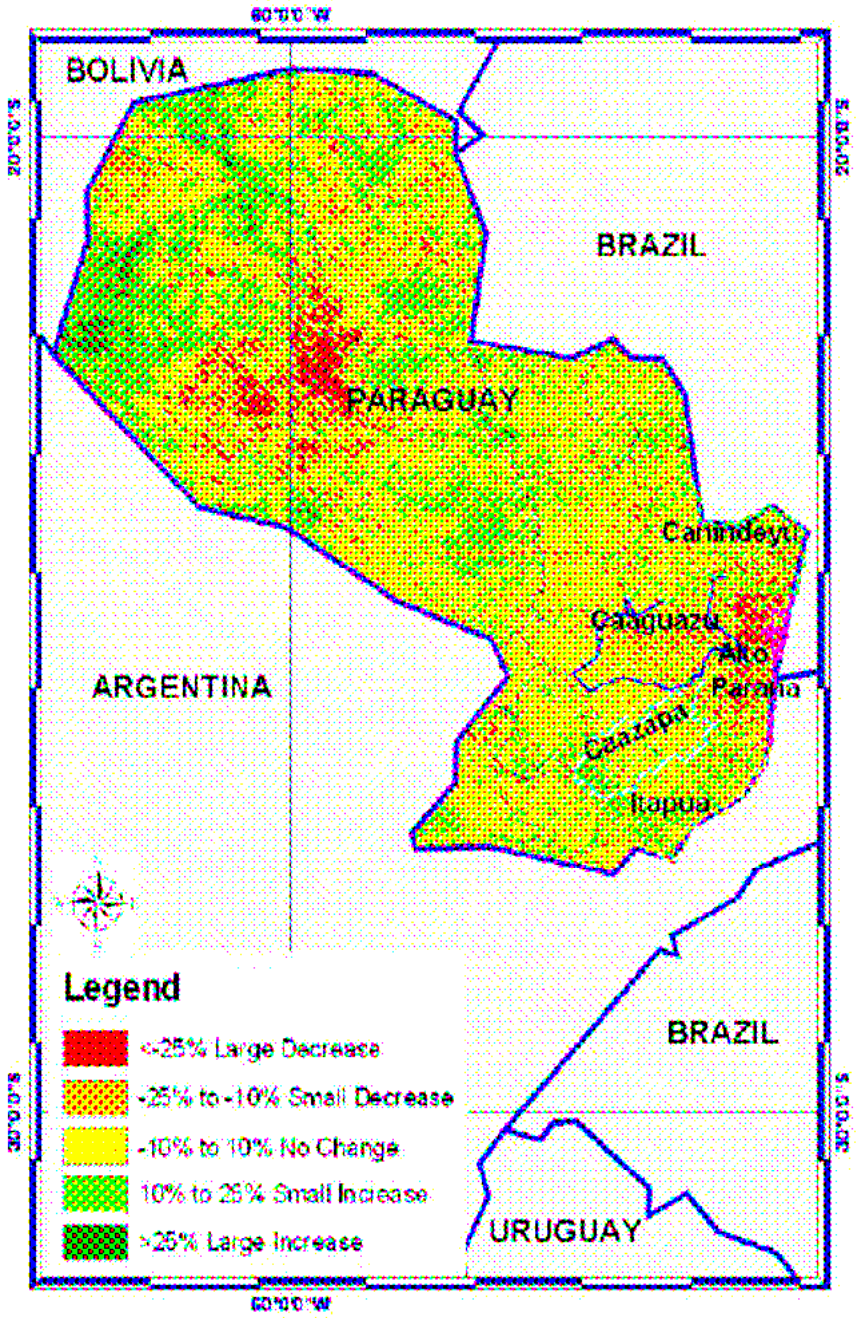
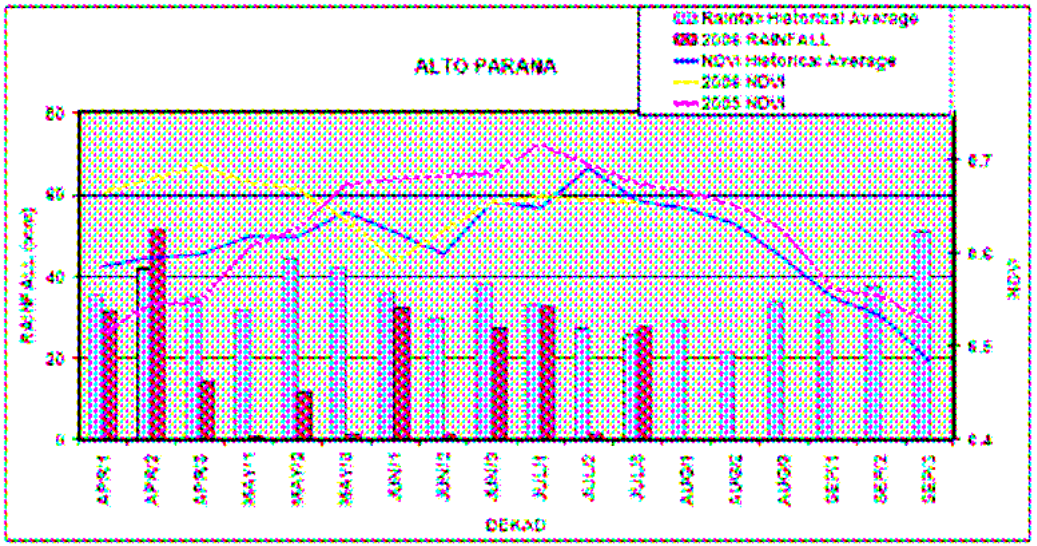
Monitoring Regions - Paraguay





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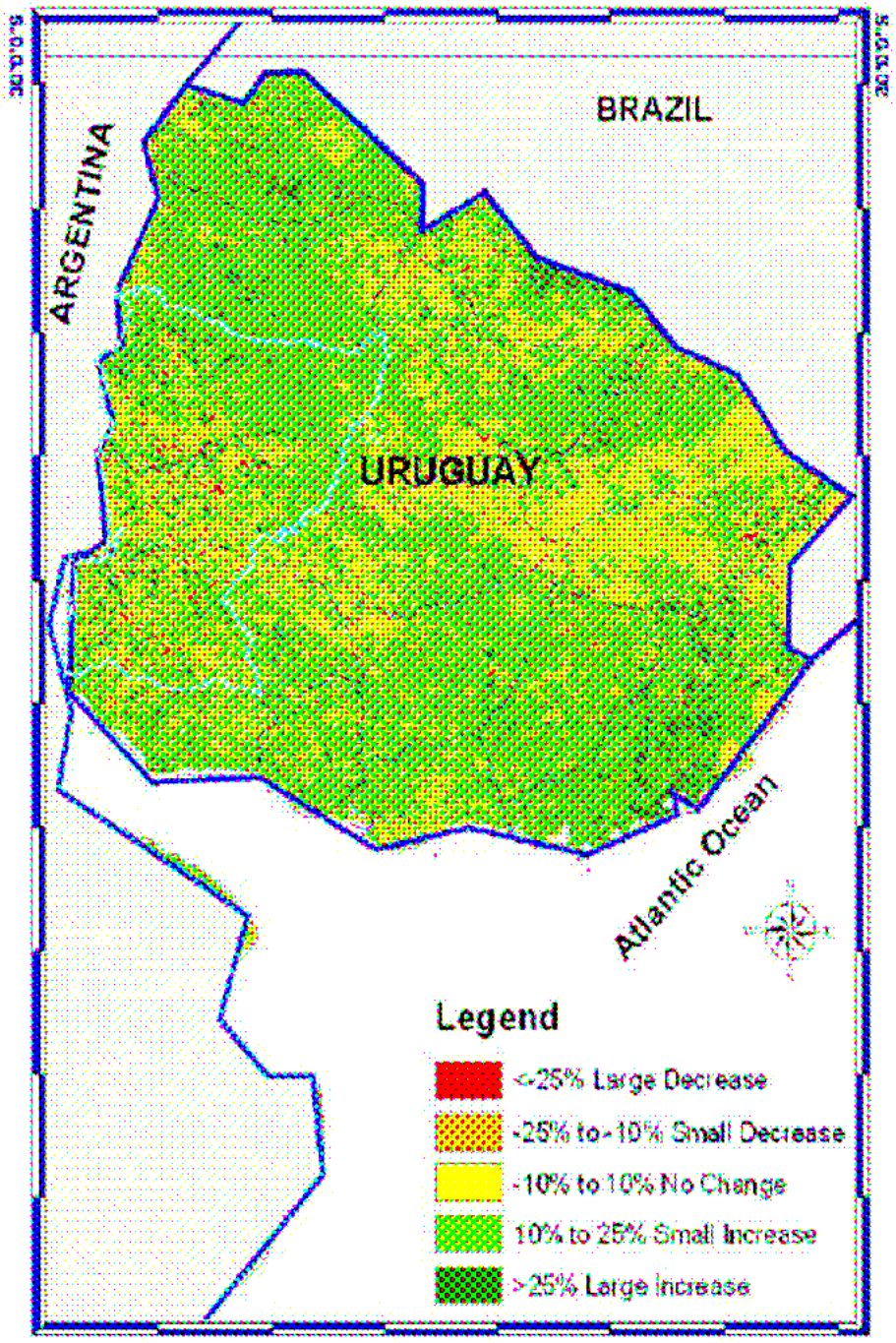
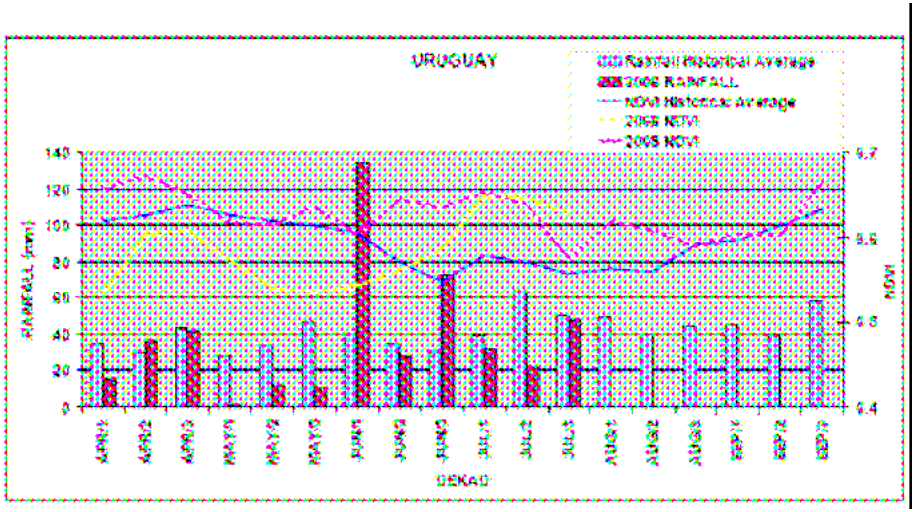
Monitoring Regions - Uruguay





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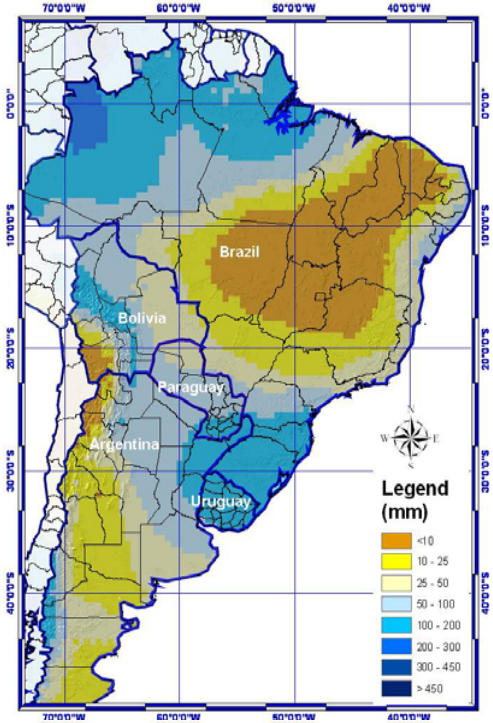
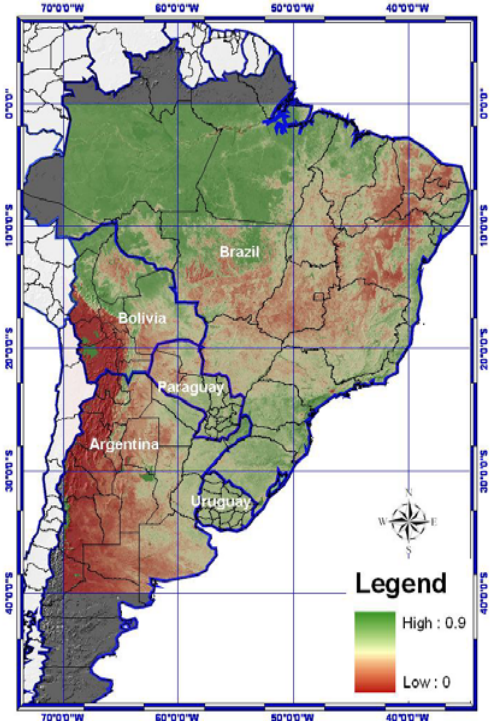
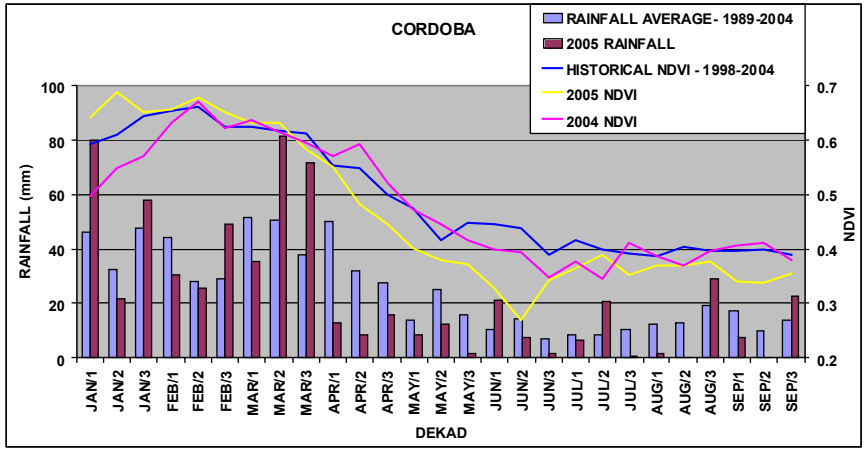
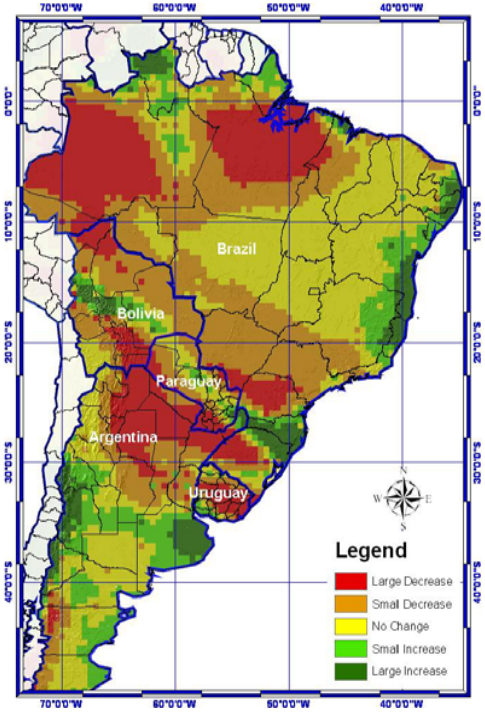
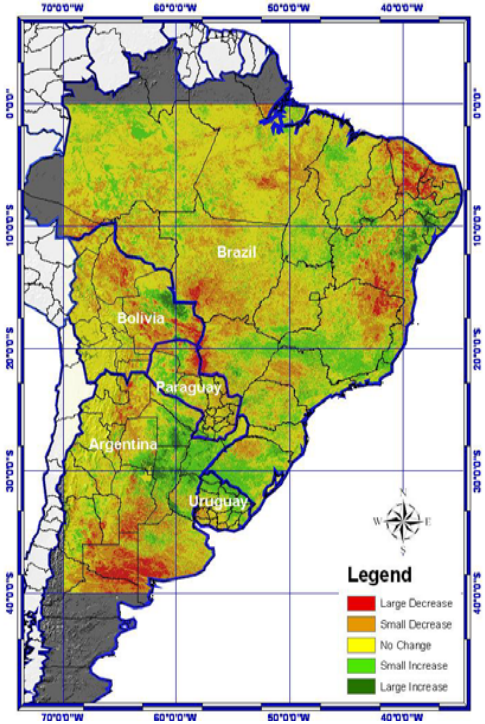
Bulletin Data
10 days



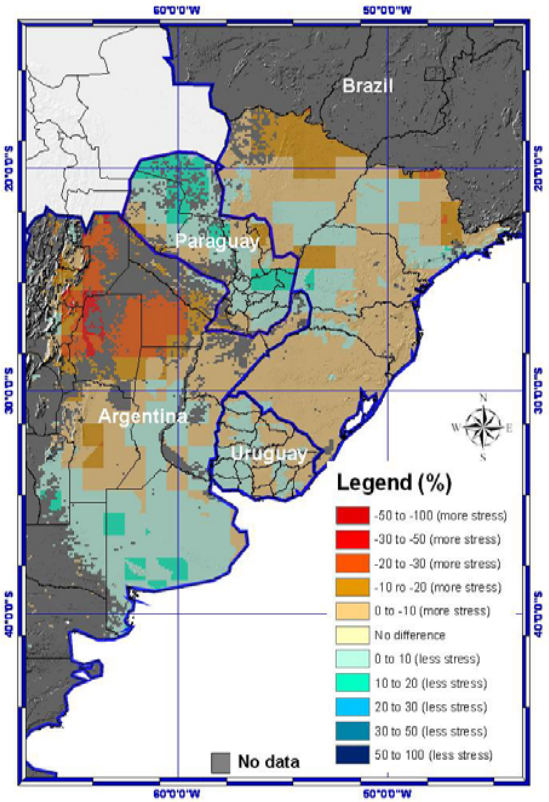




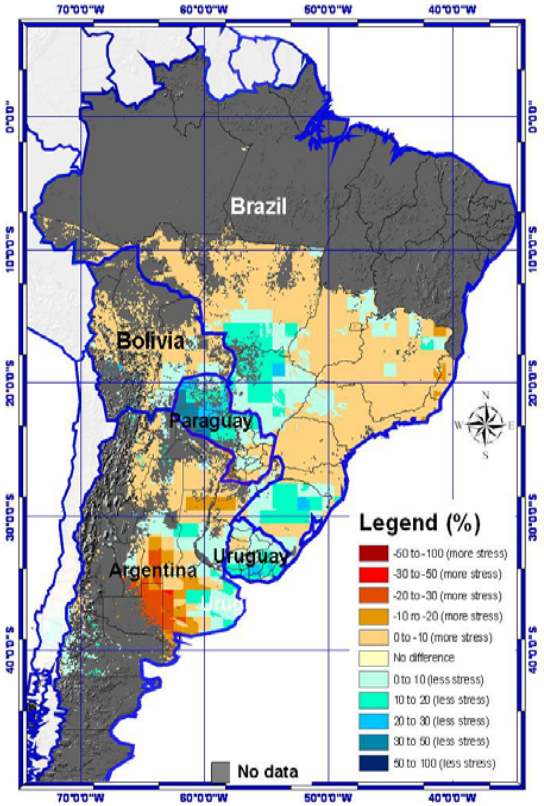




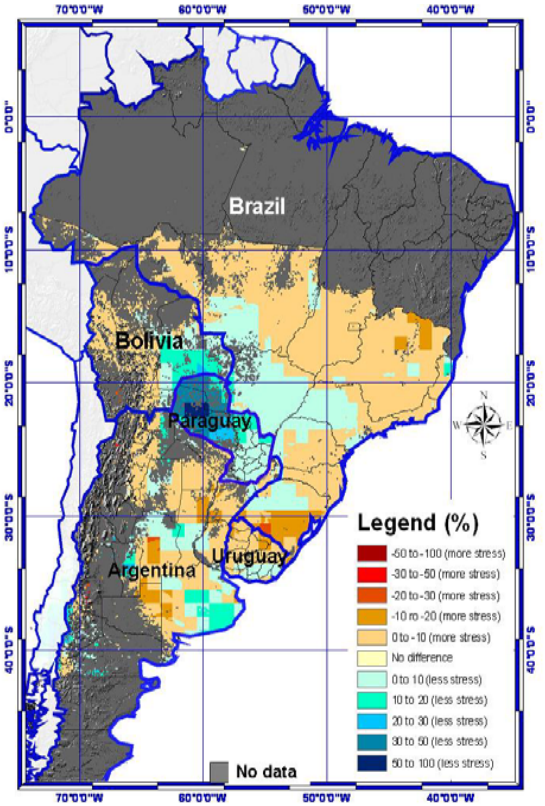
Bulletin Data
10 days



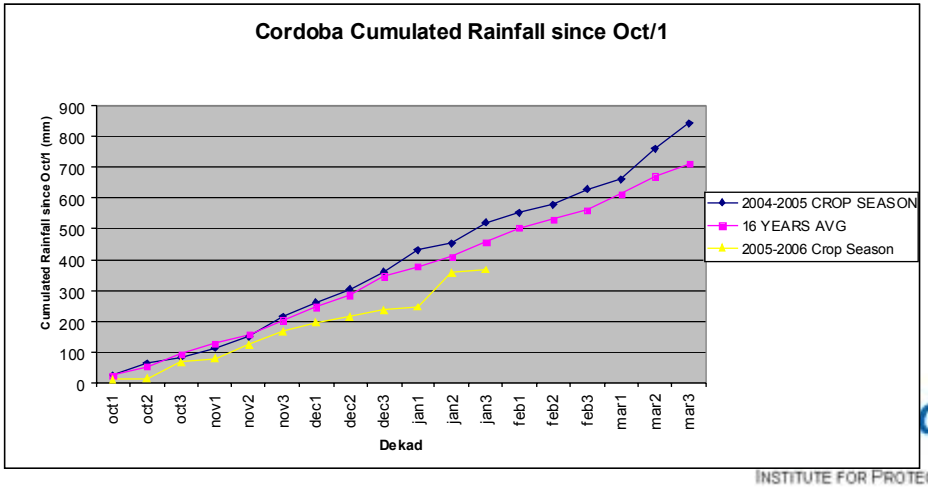
WSI difference (wheat)



WSI difference (maize)
jan2006 – jan2005



WSI difference (maize)
jan2006 – jan_avg



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CNDVI – a possibility

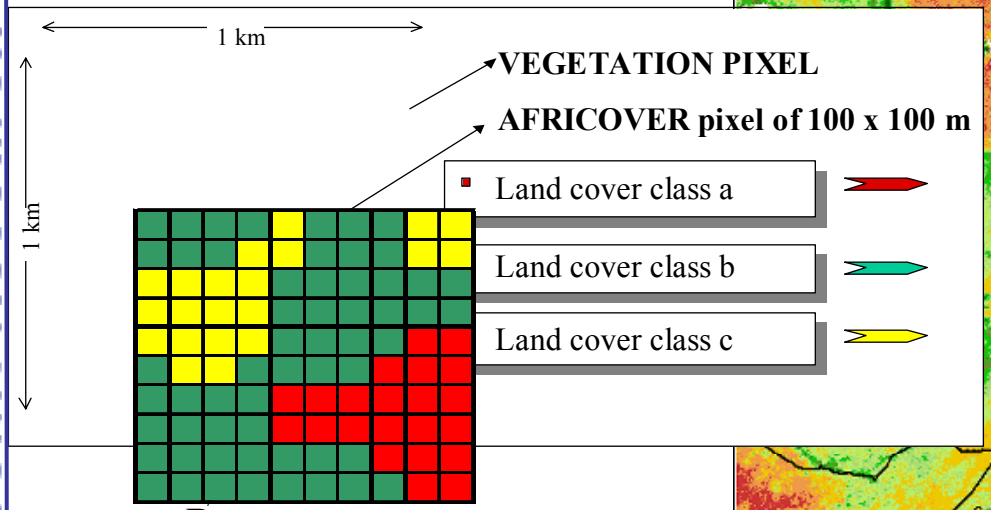
- The CNDVI technique
  - CNDVI is a method to extract crop specific NDVI profiles for mixed pixels
  - Developed by MARS for the use of NOAA AVHRR images with CORINE land cover

- Advantages
  - More information than average NDVI profiles for physical units
  - Easy to use with different images and land cover maps

CNDVI - AFRICNDVI

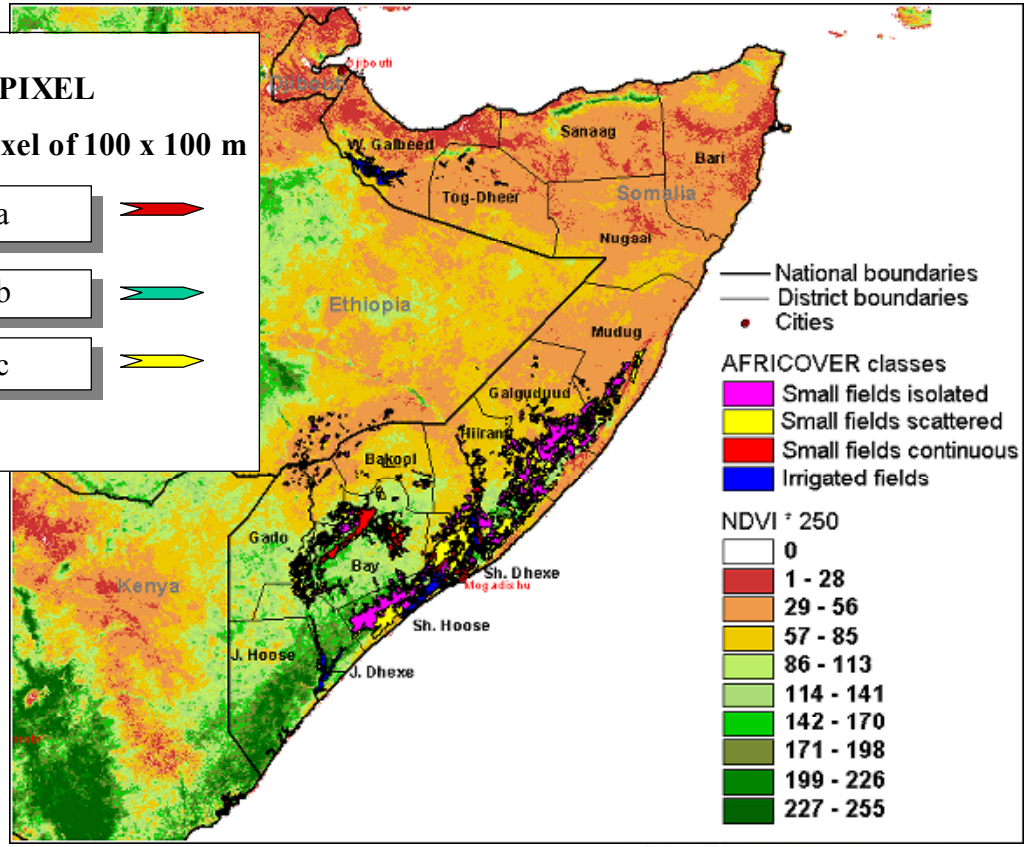
CNDVI with CORINE Land cover + NOAA/AVHRR

AFRICNDVI with AFRICOVER + VEGETATION

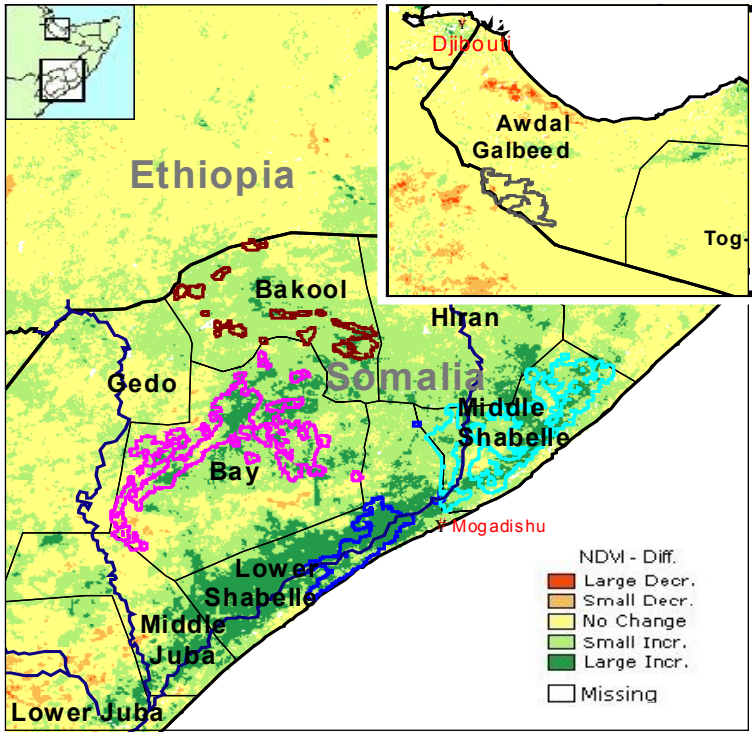


$$w_j^r = \frac{P_j}{\sum_{j=1}^{n} P_j^r}$$

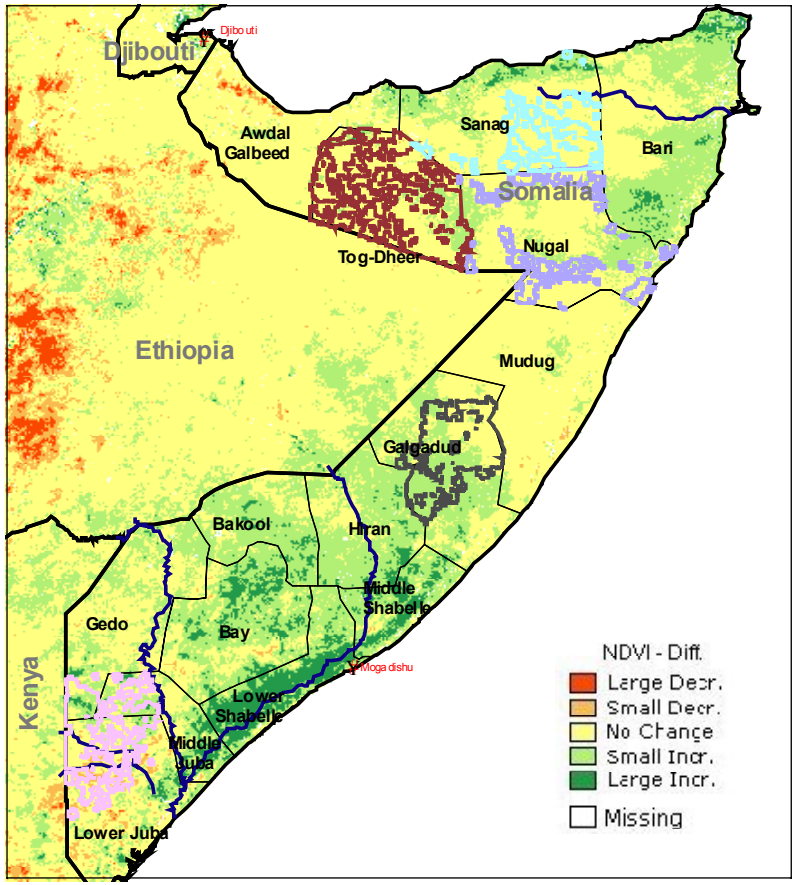
$$\hat{\mu}^r = \sum_{j=1}^{n} mvcNDVI_j^r w_j^r = AFRICNDVI$$



Agricultural areas



Pastoral areas



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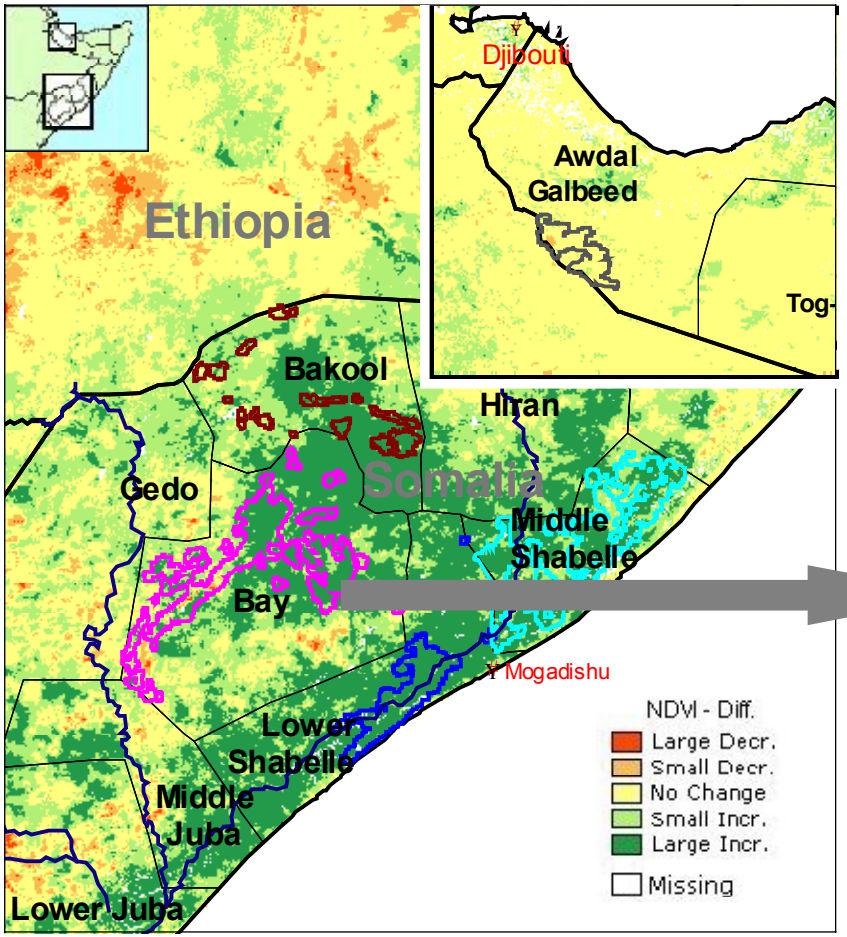
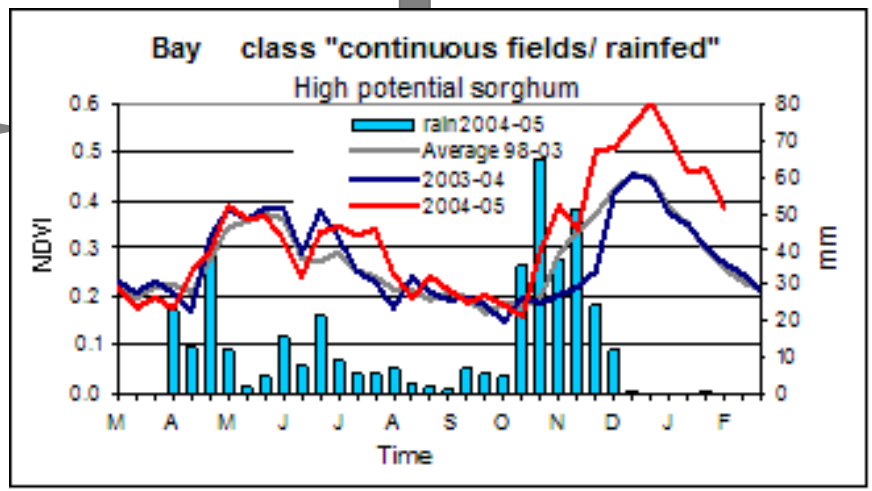
•Crop monitoring outputs: 10-daily country reports

Somalia status 10/01/2005



Forecast for Sorghum 2004/2005: expected yield is better than average and previous season.



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MARS-FOOD

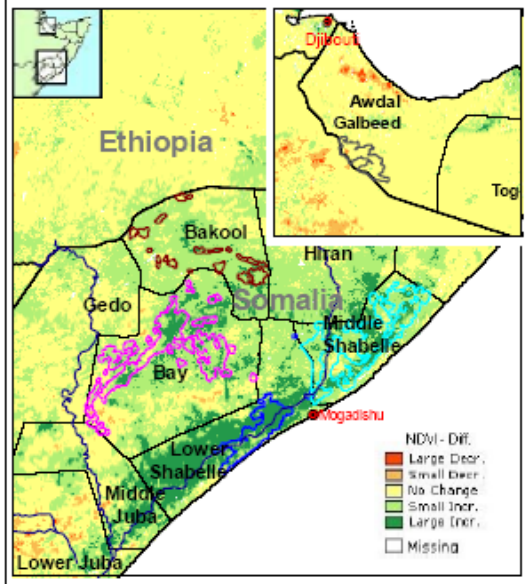
Monitoring agricultural vegetation in Somalia using SPOT VGT Vegetation Index, AFRICOVER and ECMWF Global Meteorological Modelling

Year 2005
No. 04

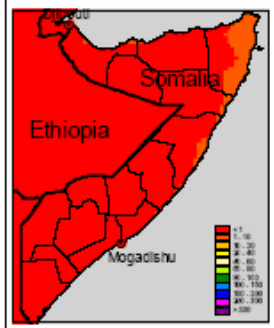
10-day product: 01 – 10 February 2005

Date
17.02.2005

Agricultural areas



Normalized Difference Vegetation Index (NDVI)
Absolute difference w.r.t. previous year (Act. – Prev.)
Period: February 2005 Dekad: I



10-day cumulated rainfall
Period: February 2005 Dekad: I
Data derived from ECMWF model
Produced by METEOCONSULT

Highlights

Rainfall

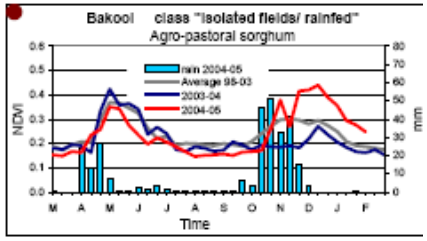
No significant rainfall is visible on the ECMWF model output as expected for this season.

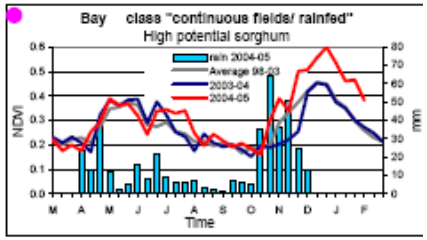
Crops

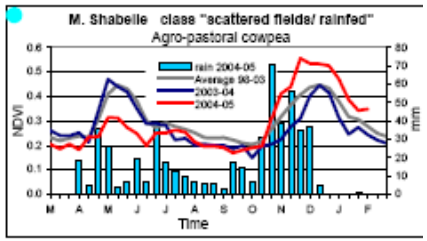
The *Deyr* crop development looks definitely more vigorous compared to normal and in particular compared to the same season in 2003. Crop yield is expected to be better than in 2003. However, irrigated maize is reported to have suffered from floodings.

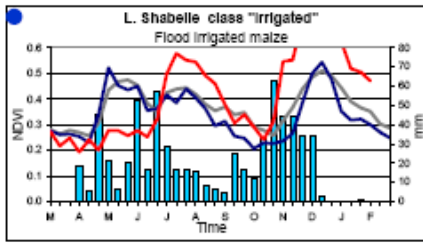
Natural vegetation appears much greener than at the same time in 2004.

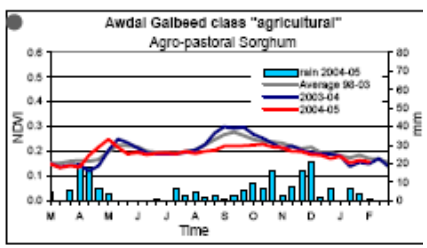
Legend: Food crop situation:
Very bad; Bad; Near Normal; Good; Very Good











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Contact: Jacques Delincé, Head of AGRIFISH Unit. Fax: +39-0332-789029, E-mail: thierry.negre@jrc.it, felix.rembold@jrc.it,
Download address: http://agrifish.jrc.it/marsfood/ and ftp://agrifish.jrc.it/bulletin/somalia

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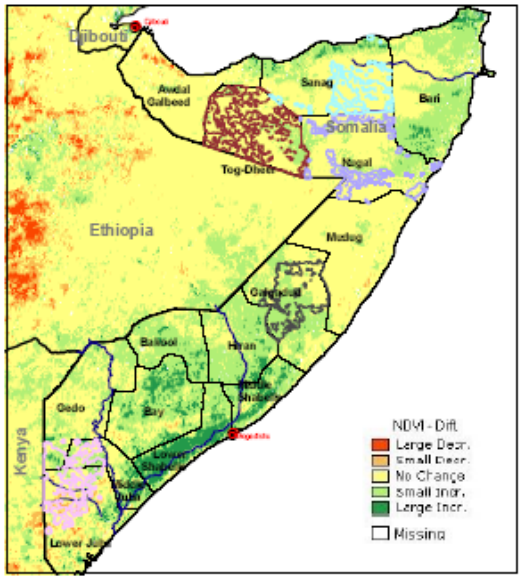
10-day product: 01 – 10 February 2005

Pastoral areas



Normalized Difference Vegetation Index (NDVI)
Absolute difference w.r.t. previous year (Act. – Prev.)
Period: February 2005 Dekad: I

Highlights

Pastures

In general the high rainfall of late 2004 helps natural vegetation to recover from the long drought in the central pastoral areas. The situation is improving also in the North of the country, but it will take time for pastoral livelihoods to recover from the long drought of the last 3 years.

N.B.: Please note that to improve visualization, the scale of NDVI for the 3 dry pastoral regions of the North is bigger than in the other graphs.

Legend: Food crop situation:
Very bad; Bad; Near Normal; Good; Very Good

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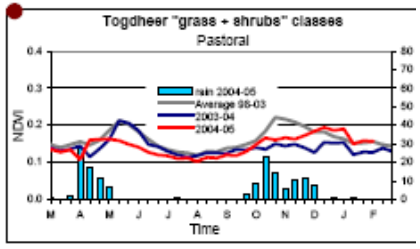

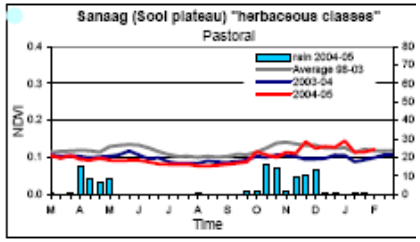

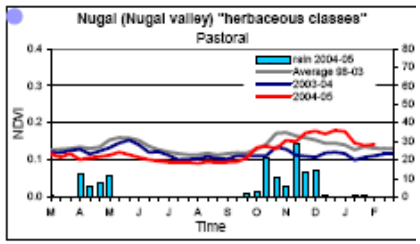

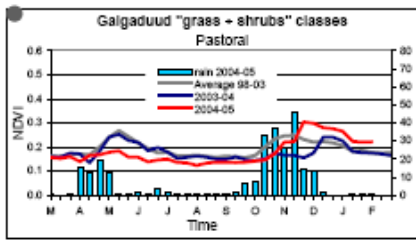

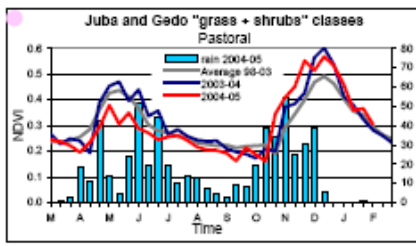

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Objectives

- data comparison/calibration
- methodology development
- crop mask
- crop monitoring information system for the region