Monitoring Agriculture with Remote-Sensing MARS
EUROPEAN COMMISSION
Joint Research Centre
I.P.S.C - MARS Unit
ipsc Institute for the Protection and Security of the Citizen

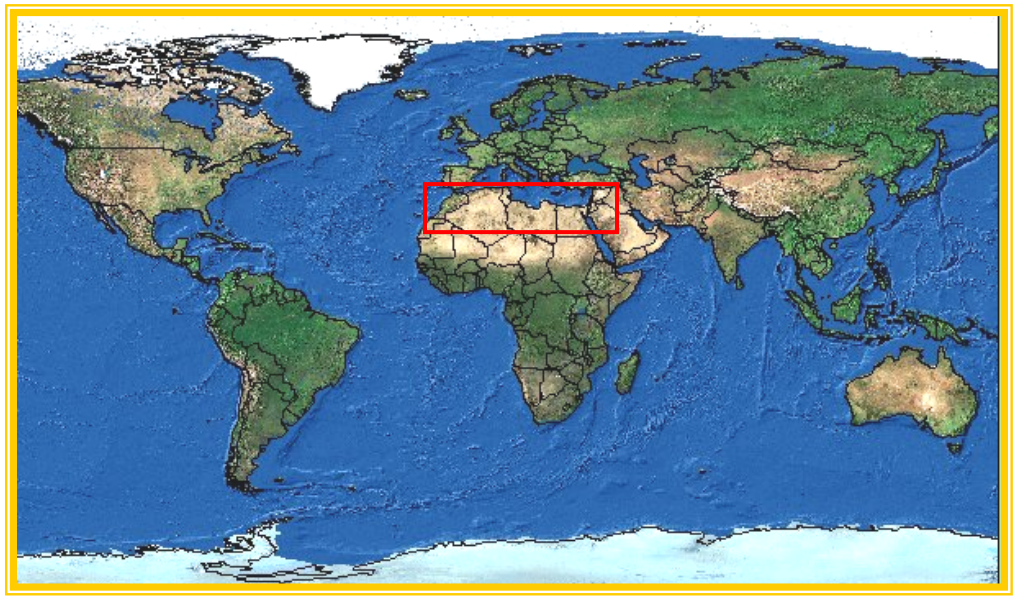
MONITORING AGRICULTURE for FOOD SECURITY

South and East Mediterranean Countries

Situation at the End of March 2004

Agro-meteorological overview for February - March 2004

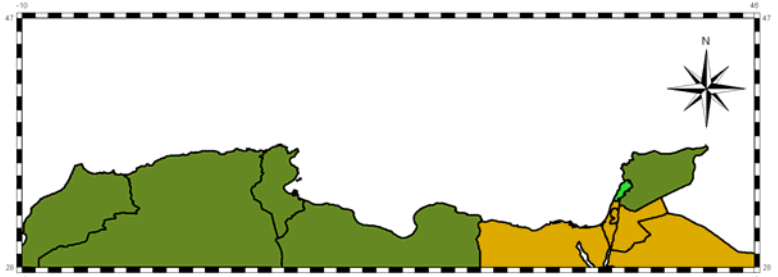
Pilot Bulletin №1 2004



Introduction

The present Bulletin is dedicated to the analysis of the agro-meteorological situation in the non-European countries of the Mediterranean basin during the period from the beginning of February to the end of March 2004. This is a period for winter crops heading and flowering in most countries of the region. Practically in all countries wheat and barley are the main winter crops. Additionally, sugar beets are cultivated in winter in Tunisia and Israel, as well as potatoes in Morocco. The main part of winter crops is cultivated in rain-fed conditions. In Israel, Libya and Syria about 20-30% of winter cereal crops and in Egypt and Saudi Arabia practically all crops are irrigated. The present Bulletin is devoted to the analysis of the meteorological conditions only for winter cereals.

The monitoring of the agro-meteorological situation is based on the analysis of the following dekadal data: minimal, maximal and average air temperature, sums of precipitation and global radiation, dekadal values of the climatic water balance, dekadal maps of the Normalized Difference Vegetation Indexes (NDVI), dekadal maps of Dry Matter Production. Meteorological data are derived from the outputs of the numerical meteorological model from ECMWF (UK), and were prepared for analysis by METEOCONSULT (NL). SPOT-VEGETATION data were used as a basis for calculation of the remote sensing indicators of crop growth. Data were preprocessed by VITO (BE). After that, dekadal maximal NDVI values were weighted for pixels within which winter crops are cultivated, and then – were weighted again on country level. Thus, weighted NDVI values were used as an indicator of crop status. Dry Matter Production maps were calculated by VITO based on SPOT-VEGETATION data and information about global radiation, applying the Monteith approach.
The Bulletin has the following structure. The first pages contain the main results of the analysis. The following pages are dedicated to the analysis of separate indicators of the crop growth during the period of analysis.



***Winter crop development stage during February-March**:*
green – shooting-heading; olive-green – heading-flowering;
gold – flowering-ripening.
(based on long-term average data, and on the analysis of Remote

Acknowledgements. *The following organizations were involved in data supply: VITO (BE), METEOCONSULT (NL), ECMWF (UK).*
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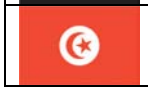
Highlights

Meteorological conditions during February-March 2004 were favorable for winter crops development in Maghreb countries, Syria, and Lebanon, and were unfavorable in eastern Libya, and in Eastern Mediterranean countries due to the low amount of precipitation. The meteorological situation was less favorable than in February-March 2003, but the whole current vegetative season in the region is slightly better or close to the previous season due to favorable conditions before February.

Country by Country

	**Algeria**	The meteorological conditions during February-March were favorable for winter crops development, and close to the previous year. If the weather will be normal during coming month, the yield of winter cereals seems to be close to the previous year or slightly higher.
	**Egypt**	The meteorological conditions during February-March were close to the previous year. The yield of winter cereals seems to be close to the previous year.
	**Israel**	The meteorological conditions during February-March were slightly worse comparing with the previous year. If the weather will be normal during coming month, the yield of winter cereals seems to be close to the previous year.
	**Jordan**	The meteorological conditions during February-March were slightly worse comparing with the previous year. If the weather will be normal during coming month, the yield of winter cereals seems to be close to the previous year.
	**Lebanon**	The meteorological conditions during February-March were slightly worse comparing with the previous year. But, if the weather will be normal during coming month, the yield of winter cereals seems to be slightly higher than in previous year.
	**Libya**	The meteorological conditions during February-March were slightly worse comparing with the previous year, especially at the eastern part of the country. If the weather will be normal during coming month, the yield of winter cereals seems to be close to the previous year.
	**Morocco**	The meteorological conditions during February-March were favorable for winter crops development, and close to the previous year. If the weather will be normal during coming month, the yield of winter cereals seems to be close to the previous year or slightly higher.
	**Palestine Auth.**	The meteorological conditions during February-March were slightly worse comparing with the previous year. If the weather will be normal during coming month, the yield of winter cereals seems to be close to the previous year.
	**Saudi Arabia**	The meteorological conditions during February-March were close to the previous year. The yield of winter cereals seems to be close to the previous year.
	**Syria**	The meteorological conditions during February-March were slightly worse comparing with the previous year. But, if the weather will be normal during coming month, the yield of winter cereals seems to be slightly higher than in previous year.
	**Tunisia**	The meteorological conditions during February-March were close to the previous year. The yield of winter cereals seems to be close to the previous year.

The situation is detailed in the following pages.

Results of the analysis

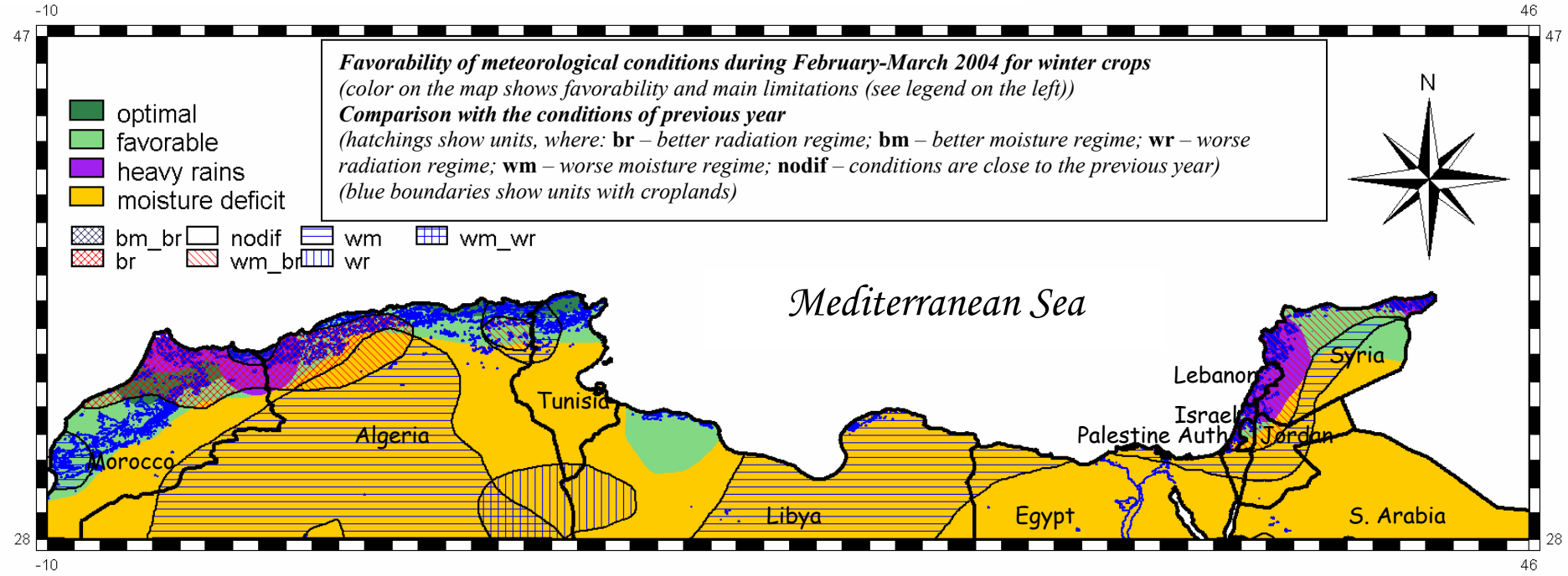
The meteorological conditions during February-March 2004 were favorable and close to optimal for winter crops in the main cropping areas of Morocco, Algeria, Tunisia, Syria, and Lebanon. Heavy rains, which took place in some dekads near the border between Morocco and Algeria, in Lebanon and western Syria, should affect winter crop growth during the period under analysis in these countries. Amount of precipitation unfavorable for rain-fed winter crops was observed only for croplands in Jordan, and in eastern Libya.

In general, the moisture and radiation regime during February-March 2004 was better compared with the previous year only in Morocco and in western Algeria. Worse moisture regime was observed in Eastern Mediterranean countries, and in eastern Libya.

It seems possible to conclude considering meteorological conditions of the whole current vegetative season, that in general the situation with winter crops in all countries of the region is the same or slightly better than in previous season. The analysis of crop growth indicators shows that winter crop status at the end of March 2004 seems to be better than in previous year in Algeria, Lebanon, and Syria, and seems to be close to the previous year in other countries of the region. The NDVI profiles show that during the current vegetative season winter crops were developing like in the season 2000/01 in Algeria, Lebanon, and Libya, and like in the previous season in other countries of the region.

A summary of the analysis of the meteorological conditions for the winter cereals is given in the Table.

Comparing with previous season		
Country	*Meteorological conditions during February-March*	*Crop status at the end of March 2004*
Algeria	=	+
Egypt	=	=
Israel	-	=
Jordan	-	=
Lebanon	-	+
Libya	-	=
Morocco	+	=
Palestine Auth.	-	=
Saudi Arabia	=	=
Syria	-	+
Tunisia	=	=



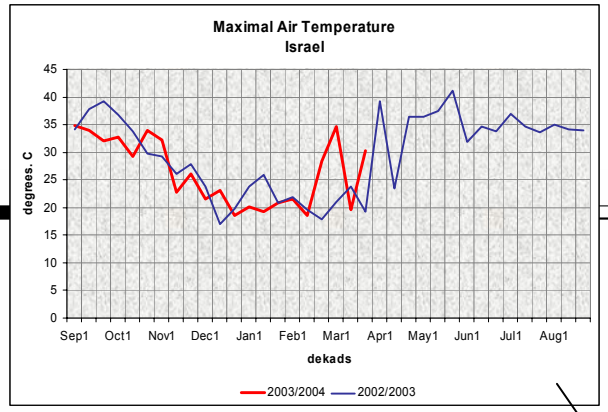
Global Radiation and Air Temperature

The amount of radiation was near long-term average values in all countries of the region. When comparing values of cumulated radiation during February-March with the similar period of last year it is possible to conclude that the radiation sum was higher in most countries of the region, excluding Egypt, Libya, Tunisia, and Saudi Arabia, where the difference in radiation sum wasn't significant.

Average daily temperature was near +5+10^{0}C practically in all countries of the region. Tmin was negative (near -5^{0}C) at the end of February in Syria and Lebanon, and at the beginning of March in some regions of Morocco and Algeria. Tmax wasn't higher than 30^{0}C during the period under analysis in cropping areas of Morocco, Algeria, and Tunisia. Only 2-4 days with such air temperature were observed during February-March in Syria and Lebanon. The quantity of "hot" days in Libya, Egypt, Saudi Arabia, Israel, Palestine Auth., and Jordan was near 10-15. The highest air temperature (near +40^{0}C) was observed in Egypt (end of February), and in Libya (end of March). The air temperature in general was slightly higher than in previous year in most countries of the region. Only in Morocco the temperature was slightly lower, and in western Syria and Tunisia it was close to the values of the previous year.

Global radiation	Comparing with previous season (February-March) *difference in %*
Algeria	**+3 +7**
Egypt	**-1 +1**
Israel	**+1 +6**
Jordan	**+2 +6**
Lebanon	**+5 +7**
Libya	**-2 +3**
Morocco	**+2 +7**
Palestine Auth.	**+1 +6**
Saudi Arabia	**-2 +2**
Syria	**+5 +8**
Tunisia	**-1 +3**

Difference in Global Radiation Sum (kJ/m^2) between current and previous seasons (February-March). Vertical hatching shows regions, where this difference was higher than 5%, and horizontal hatching – lower than 5%.
(blue boundaries show units with croplands)
- extreme air temperature



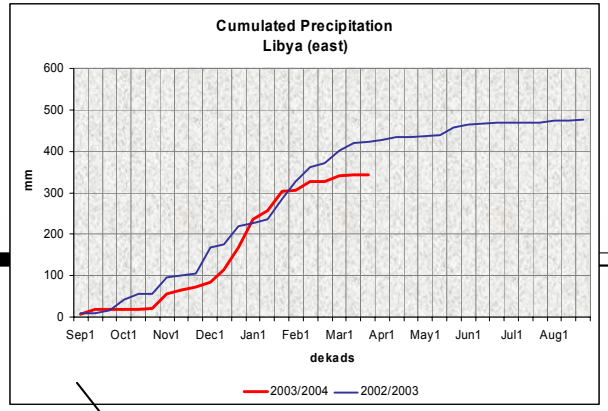
Precipitation Sum

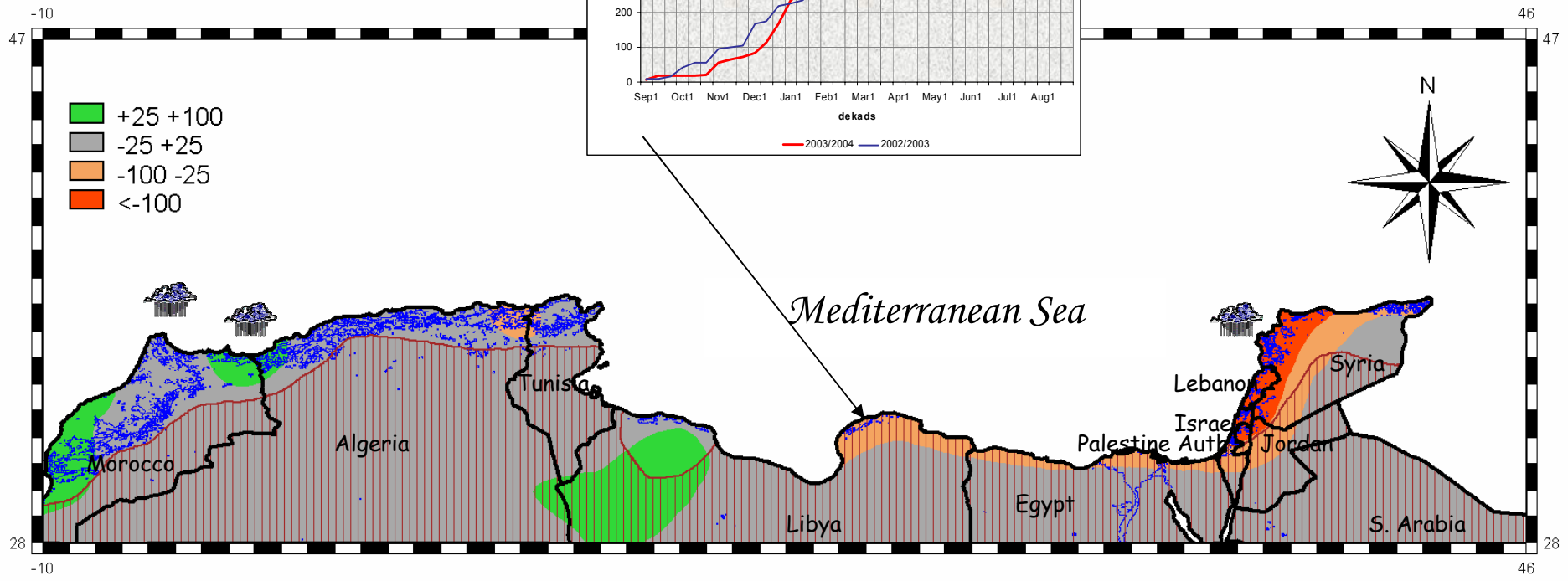
Rains were very scarce during February-March 2004 in Egypt and Saudi Arabia. Crops in the Eastern Mediterranean countries received most rainfall mid-February, while in Libya it was early March. The precipitation was distributed more evenly over time in Morocco, Algeria, and Tunisia.
In general, the amount of precipitation was close to normal in Egypt, and Saudi Arabia, and was higher in Morocco. Dekads with higher and lower than normal amount of precipitation were alternated during the period under analysis in Algeria, Tunisia, and Libya. Precipitation during March was lower than normal in the Eastern Mediterranean countries.
The amount of precipitation during February-March was higher comparing with the previous year only in Morocco, was close to the previous season in Algeria, Tunisia and Saudi Arabia, and was lower in the other countries of the region.

Precipitation for rain-fed winter crops	Comparing with previous season (February-March)
Algeria	=
Egypt	-
Israel	-
Jordan	-
Lebanon	-
Libya	-
Morocco	+
Palestine Auth.	-
Saudi Arabia	=
Syria	-
Tunisia	=

Difference in Precipitation Sum (mm) between current and previous seasons (February-March). Vertical hatching shows regions with amount of precipitation less than 60 mm during the period February-March 2004. (blue boundaries show units with croplands).


- heavy rains (more than 100 mm/dekad)



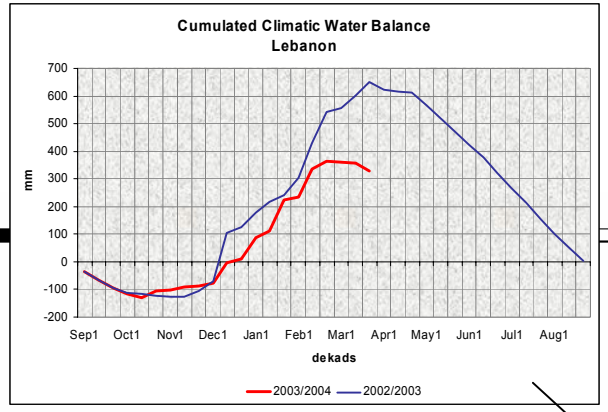


Climatic Water Balance

Dekads with negative climatic water balance (CWB) were dominant during February-March 2004 in all countries of the region. Dekads with positive CWB took place in the Eastern Mediterranean countries only in February and in Libya only at the beginning of March. Dekads with positive and negative CWB were alternated during the period under analysis in Maghreb countries. As a result the cumulated CWB during the period under analysis was positive only in some regions of Tunisia, Algeria, Morocco, Syria, and in Lebanon.
The climatic water balance situation was better than long-term average data for croplands in Maghreb and Eastern Mediterranean countries only in February.
The CWB in February-March 2004 was better than in previous year only in Morocco, and it was worse in Israel, Jordan, Palestine Auth., Lebanon, Libya, and Syria.

Climatic Water Balance for rain-fed winter crops	Comparing with previous season (February-March)
Algeria	=
Egypt	=
Israel	-
Jordan	-
Lebanon	-
Libya	-
Morocco	+
Palestine Auth.	-
Saudi Arabia	=
Syria	-
Tunisia	=

Difference in Climatic Water Balance (mm) for the period February-March 2004 and 2003. Vertical hatching shows regions with positive water balance during February-March 2004.
(blue boundaries show units with croplands)



Remote Sensing Indicators and Dry Matter Production modeling

Dekadal NDVI maps show the presence of snow cover only in February in the mountainous regions of Lebanon.
Based on the NDVI curve behavior it seems possible to conclude that winter crop development in Algeria, Lebanon, and Libya is close to the crop development in these countries during the season 2001/2002. Crop development in other countries of the region is closer to the previous season.
Analysis of the NDVI profile's maximums shows that crop status at the end of March was better comparing with previous year in Algeria, Lebanon, and Syria, and was slightly worse only for Morocco.
Dry matter production modeling in general confirms the result of the NDVI profiles analysis, and shows slightly more positive situation with crop development. It seems necessary to stress out the high level of spatial variability of dry matter production, which was modeled for Morocco, Libya, Jordan, and Palestine Auth..

Remote sensing indicators of winter crops status	Comparing with previous year	
	NDVI for winter wheat	Dry Matter Production modeling
Algeria	+	+
Egypt	=	=
Israel	=	=
Jordan	=	=
Lebanon	+	+
Libya	=	=
Morocco	-	=
Palestine Auth.	=	=
Saudi Arabia	=	=
Syria	+	+
Tunisia	=	+

Examples of weighted NDVI profiles for areas with winter wheat and for country level (blue color on the map indicates croplands)