

EVALUATION OF CROPS MOISTURE PROVISION BY SPACE REMOTE SENSING DATA

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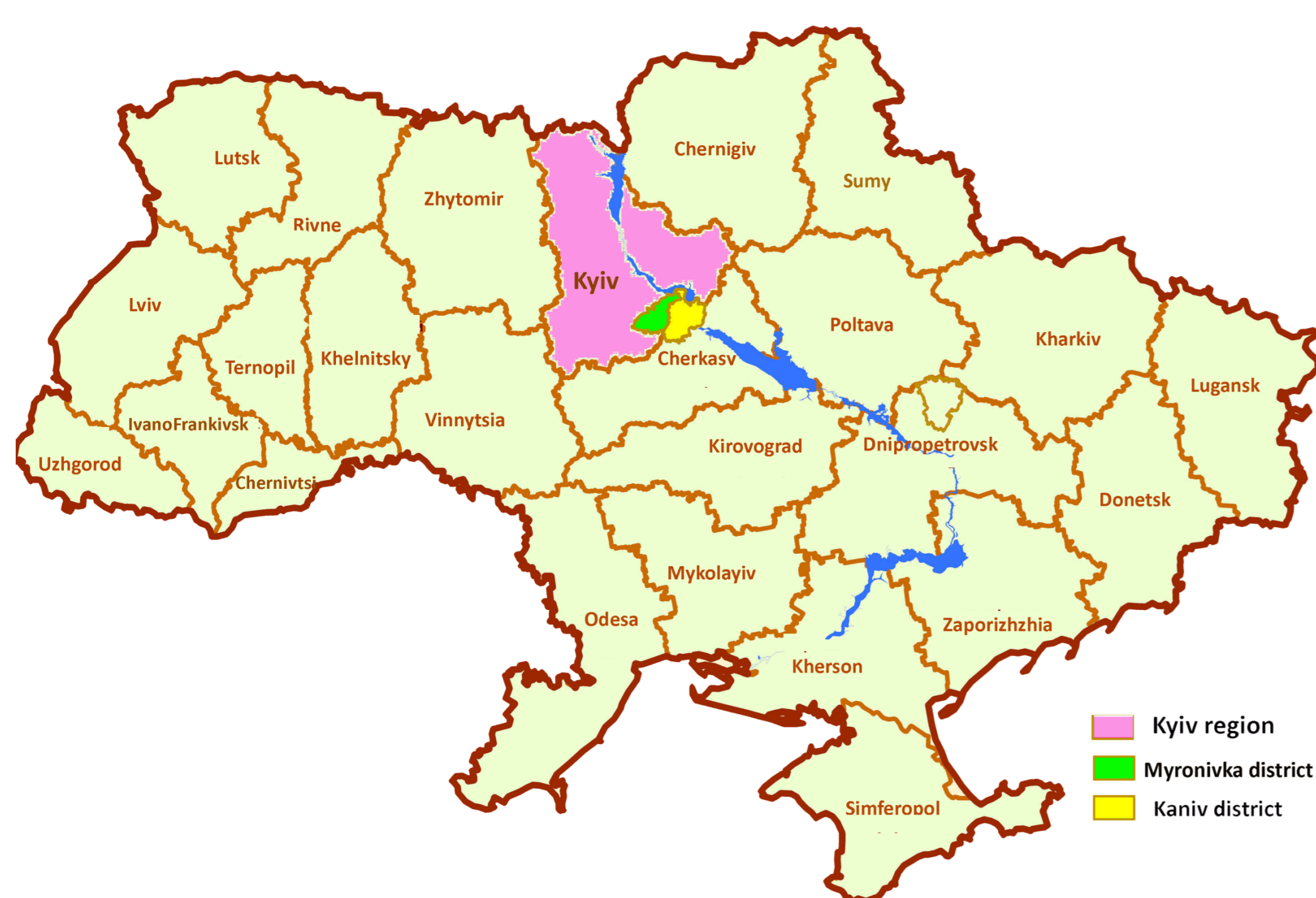
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Introduction and objectives

In Ukraine in recent decades, the rate of temperature increase is significantly higher than the average planetary indicators, which leads to increased risk of droughts. So the relevance of research is caused by necessity of improvement of the traditional monitoring system of agricultural landscapes in changing climate conditions, including diagnosis of such crises as droughts and operational information providing for business entities. Using modern satellite remote sensing systems contributes to obtaining more timely and accurate information about the status of agrophytocenoses, including moisture conditions at various administrative levels.

The aim of research is to establish relationship between crop moisture content and crop spectral characteristics and combination of spectral indices with the maximum informativity to determine plant water stress.

Study sites



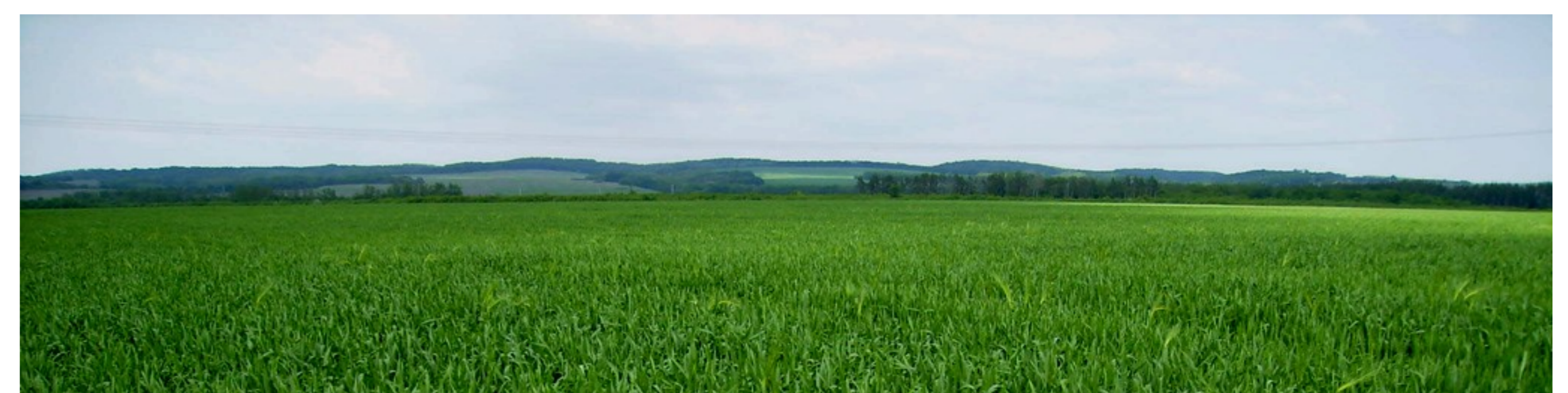
Net of test agrarian polygons



Test agrarian polygon



Test field of winter wheat



Methods and data

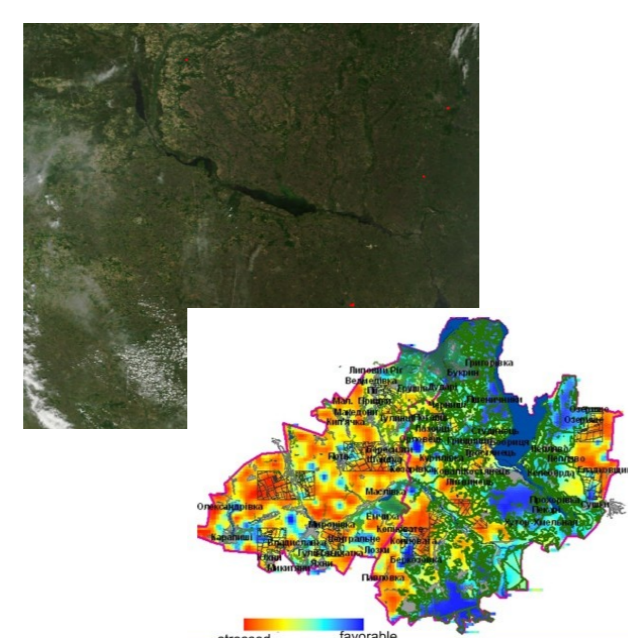
Remote sensing

- Classify imagery from Terra (MODIS), Landsat 8, RapidEye, Sich-2, to delineate winter wheat during vegetation seasons 2009 – 2015

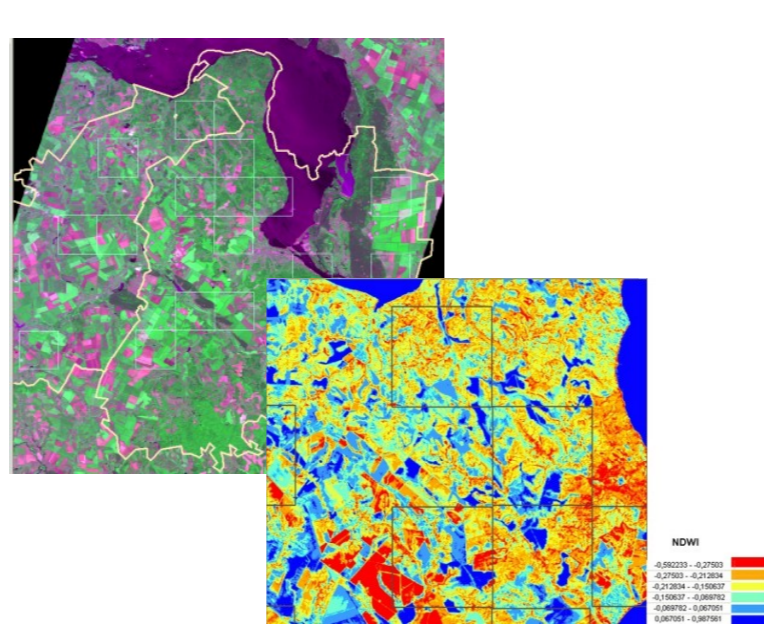
- Normalized Difference Water Index and Normalized Difference Vegetation Index Red Edge used to calculate moisture content of winter wheat

- Compare with weather variables such as amount of precipitation

MODIS/Terra, 500m



SICH-2, 8m



RapidEye, 5m



Classify imagery

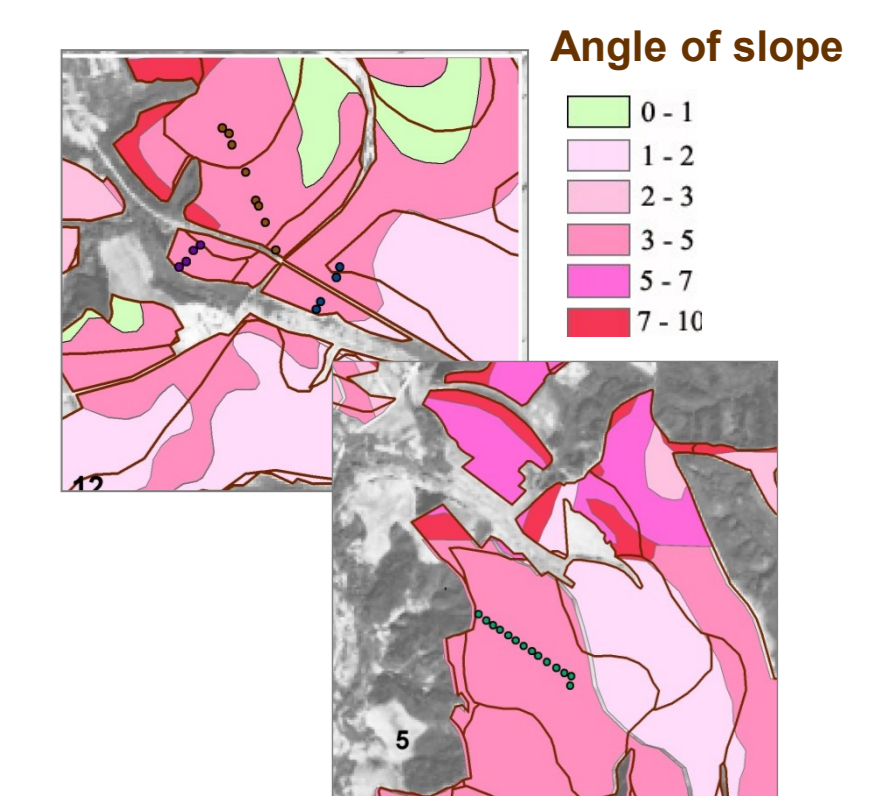
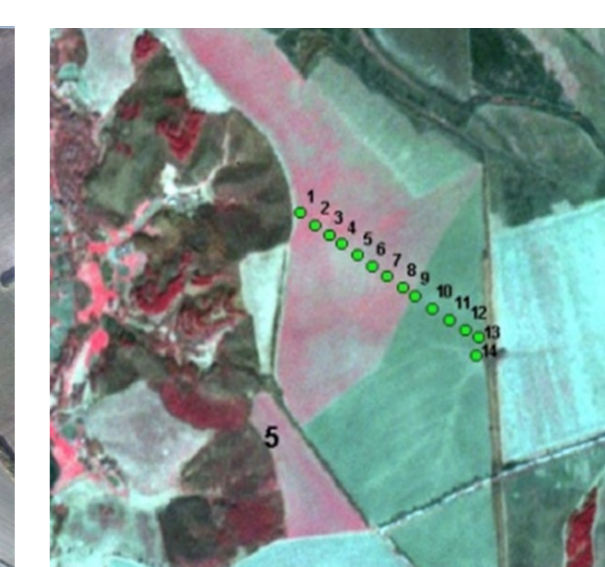
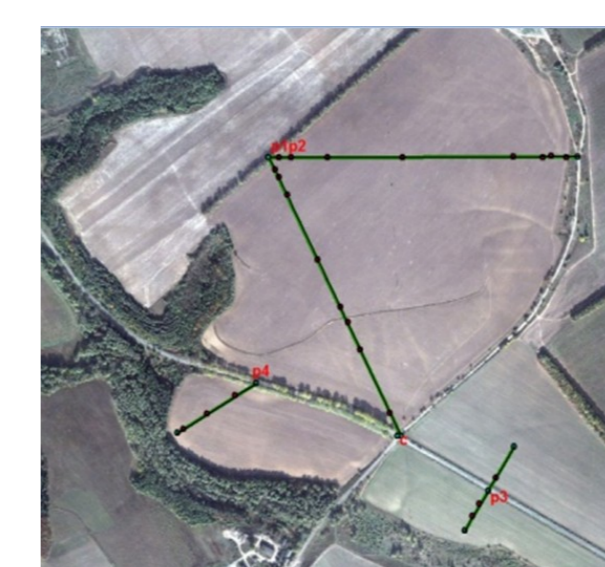
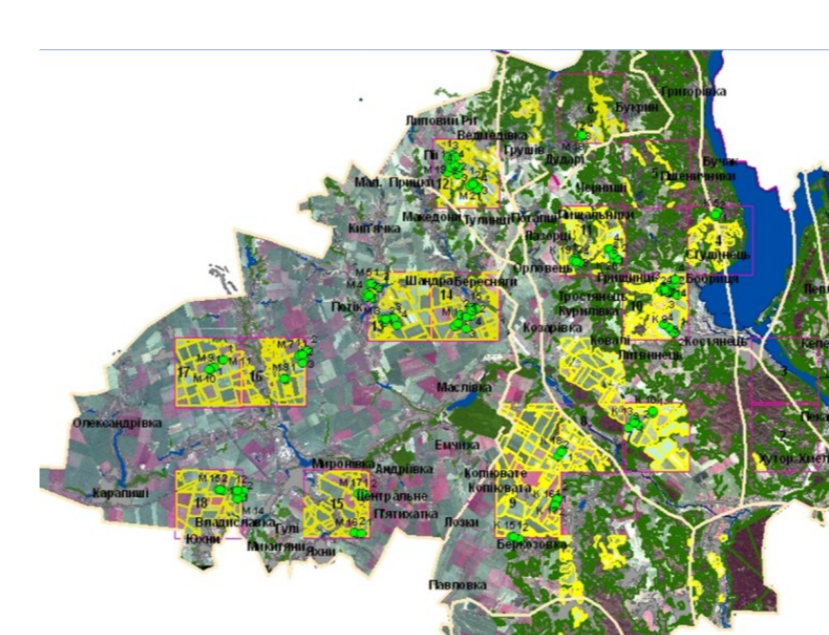


Legend for crop types: Perennial grass, sunflower, corn, barley, rape, buckwheat, winter-wheat, soya, fallow

Ground-based Research

During 2009-2015 vegetation seasons we observed more than 24 test polygons 5x5 km for obtaining supporting calibration and thematic information about crops and the data amount of hygroscopic moisture content in winter wheat plants.

Network test sites, points and routes of in-situ surveys

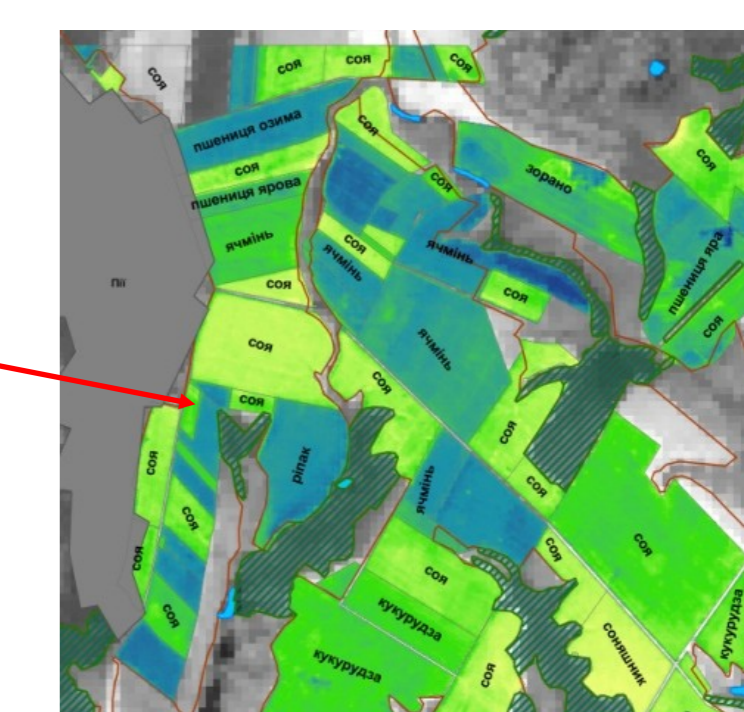
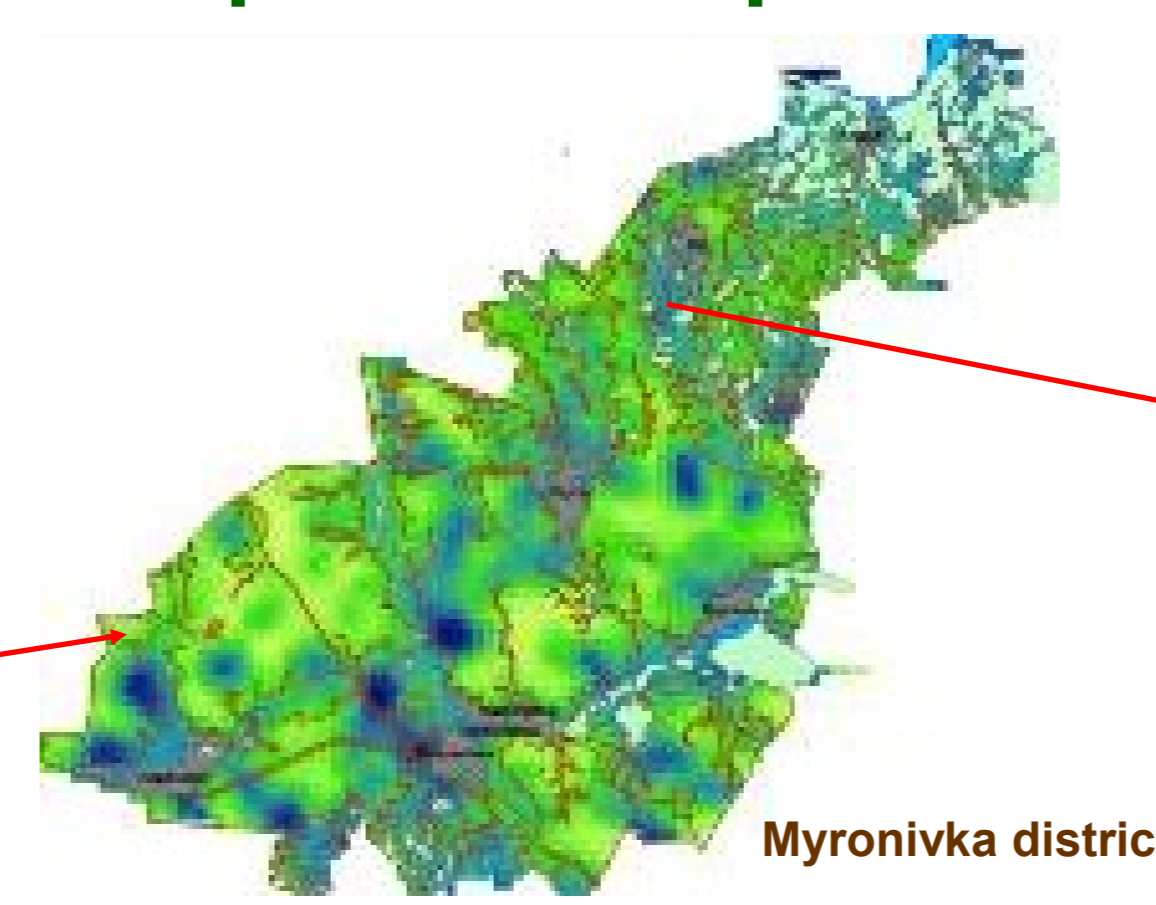
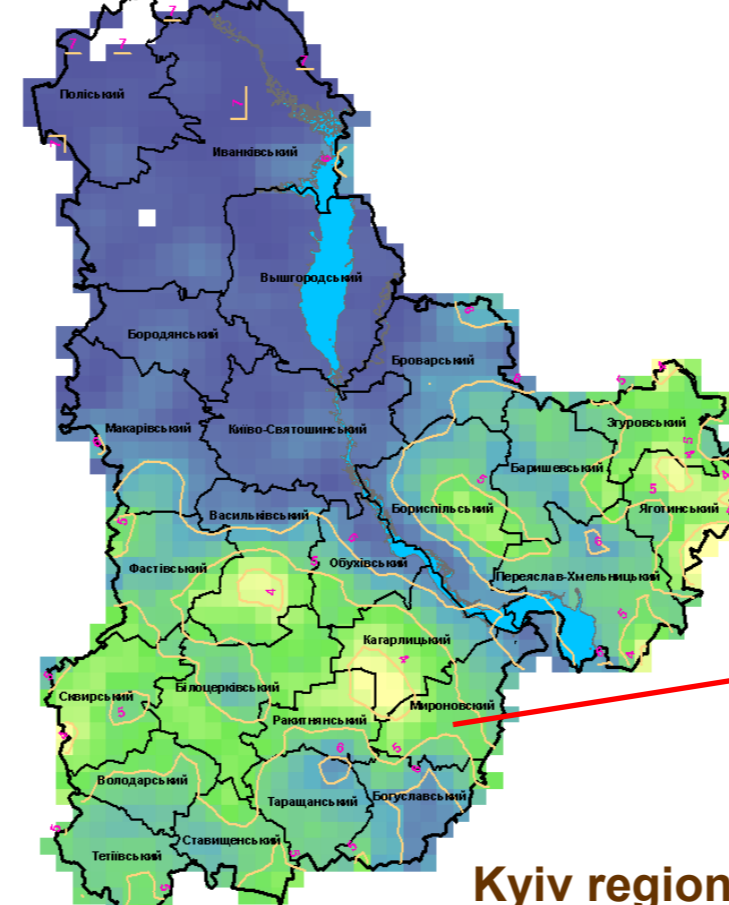


Results

Correlation analysis of spectral indices

Satellite index	Terra (MODIS)		Landsat		RapidEye	SICH-2	
	NDWI	MSI	NDWI	MSI	NDVIRE	NDWI	
Terra (MODIS)	NDWI	1	-0,871	0,918	0,783	0,940	0,856
	MSI	-0,871	1	-0,782	0,959	-0,814	-0,714
Landsat	NDWI	0,918	-0,782	1	-0,998	0,809	0,887
	MSI	0,783	0,959	-0,998	1	-0,792	-0,831
RapidEye	NDVIRE	0,940	-0,814	0,809	-0,792	1	-
SICH-2	NDWI	0,856	-0,714	0,887	-0,831	-	1

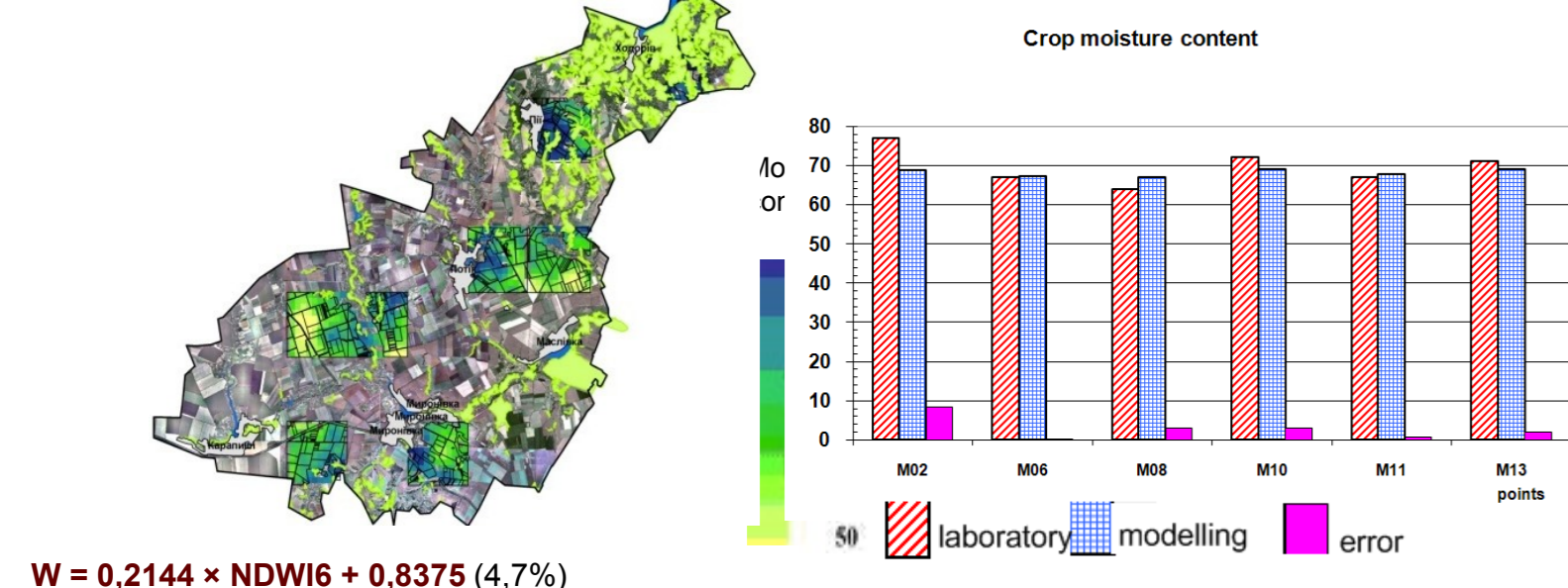
Evaluation of crop moisture provision at different administrative levels



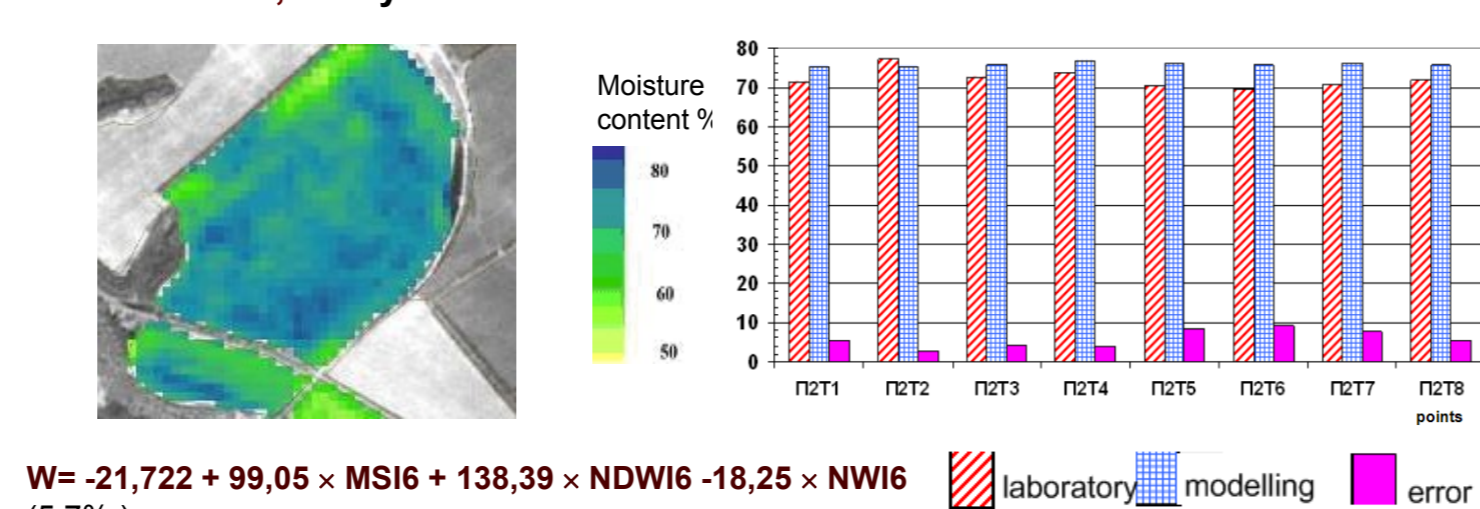
Moisture provision: low, satisfactory, high

Modelling of crop moisture content determining according to RS

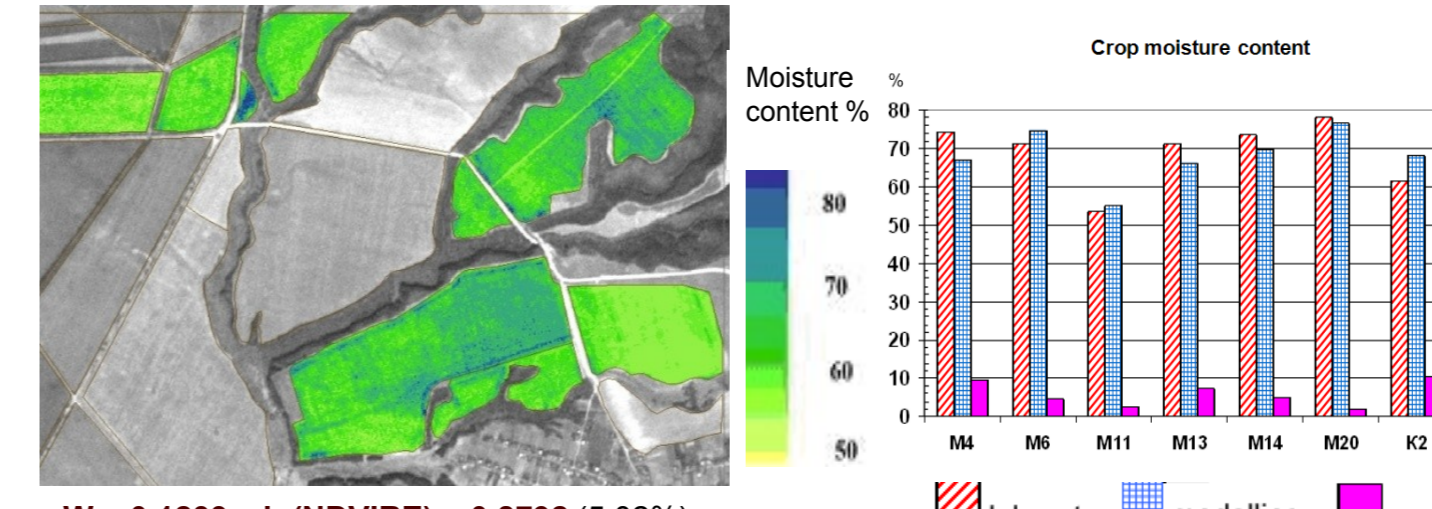
MODIS/Terra, 8 May 2015



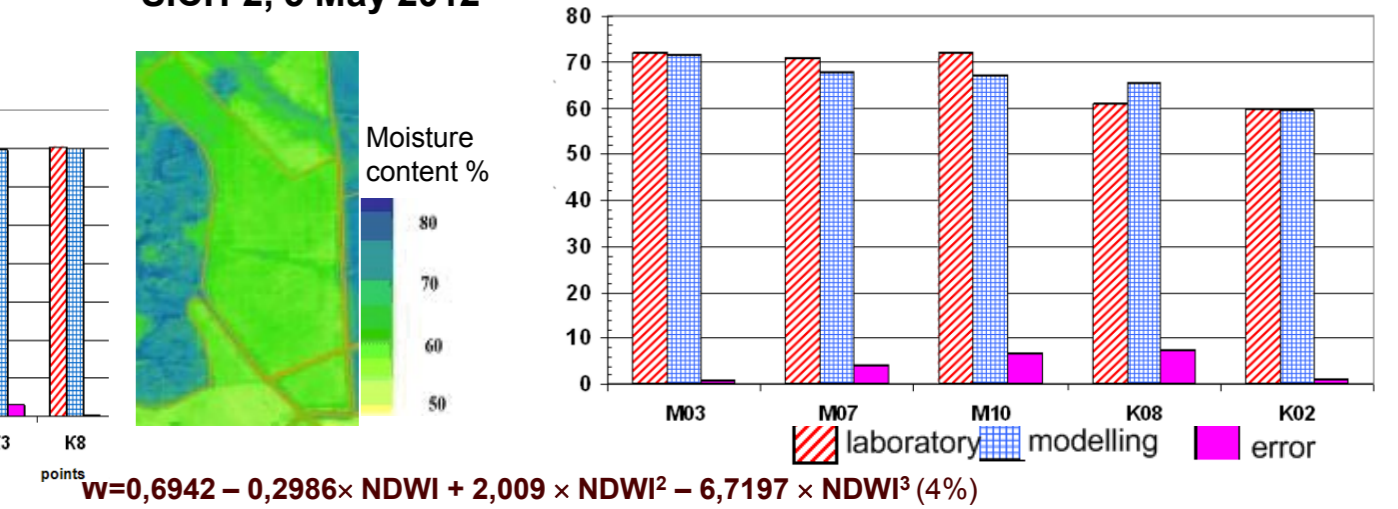
Landsat 8, 2 May 2013



RapidEye, 11 April 2009



SICH-2, 5 May 2012



Conclusions

- During the work the effectiveness of modern satellite remote sensing systems for rapid assessment of moisture agrophytocenoses was proved.
- From the correlation analysis we can conclude that there is a high correlation between the indices obtained for satellite data of different spatial resolution by fields of crops.

To determine the agrophytocenosis moisture content at the local level it was proved the possibility of replacement of satellite imagery of high spatial resolution (RapidEye, SICH-2), on medium spatial resolution (Landsat, MODIS/Terra), which are freely available.

The relations between the moisture content of winter wheat plants and spectral indices were found based on the results of experimental field research.

