Brno Summer School 9-13 September 2013

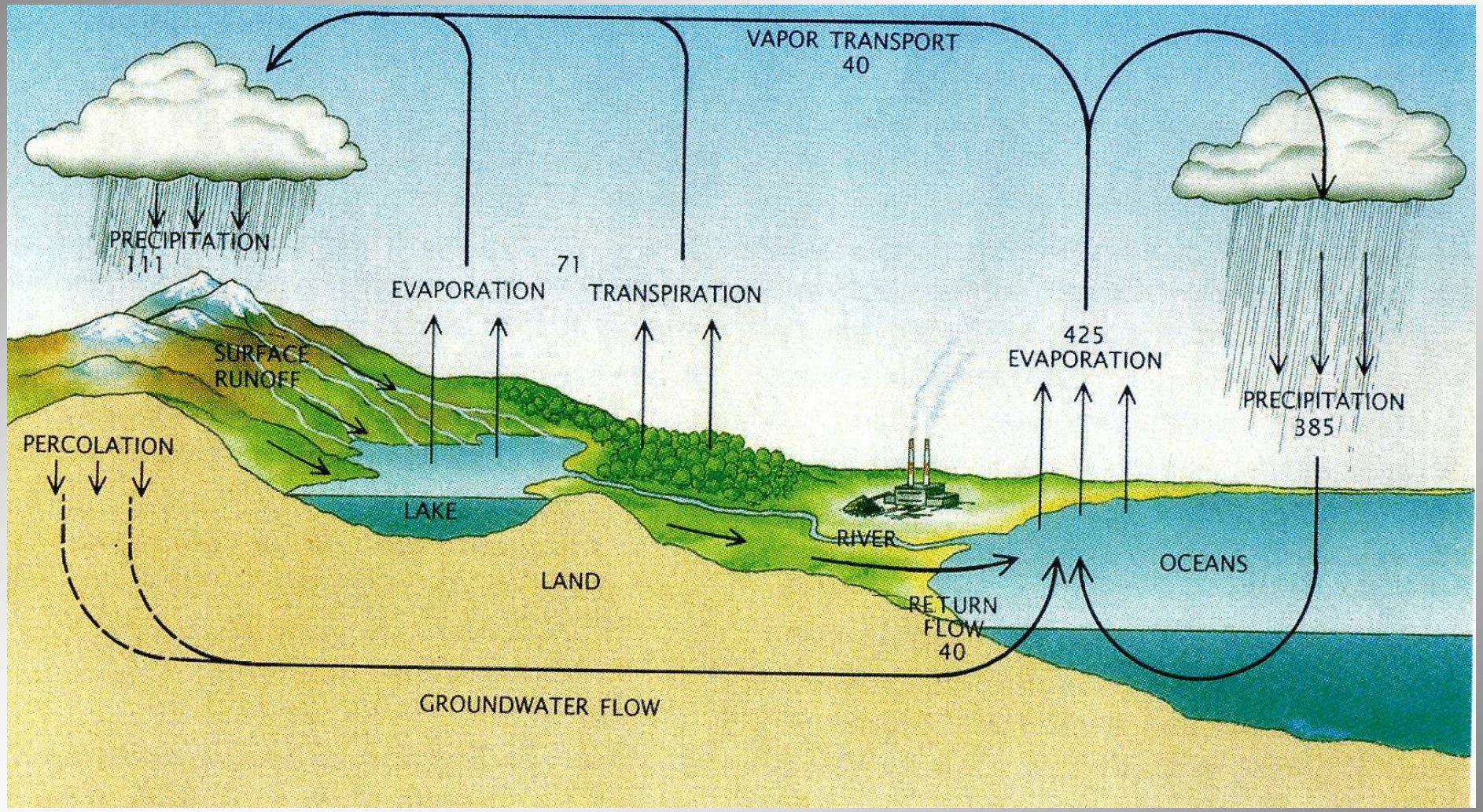
A WATER STRESS ASSESSMENT SURVEY BASED ON THE EVAPORTRANSPIRATION BALANCE OF MAJOR FIELD CROP SPECIES

Ágnes FEKETE – Ákos TARNAWA – Márton JOLÁNKAI
Szent István University, Gödöllő, Hungary

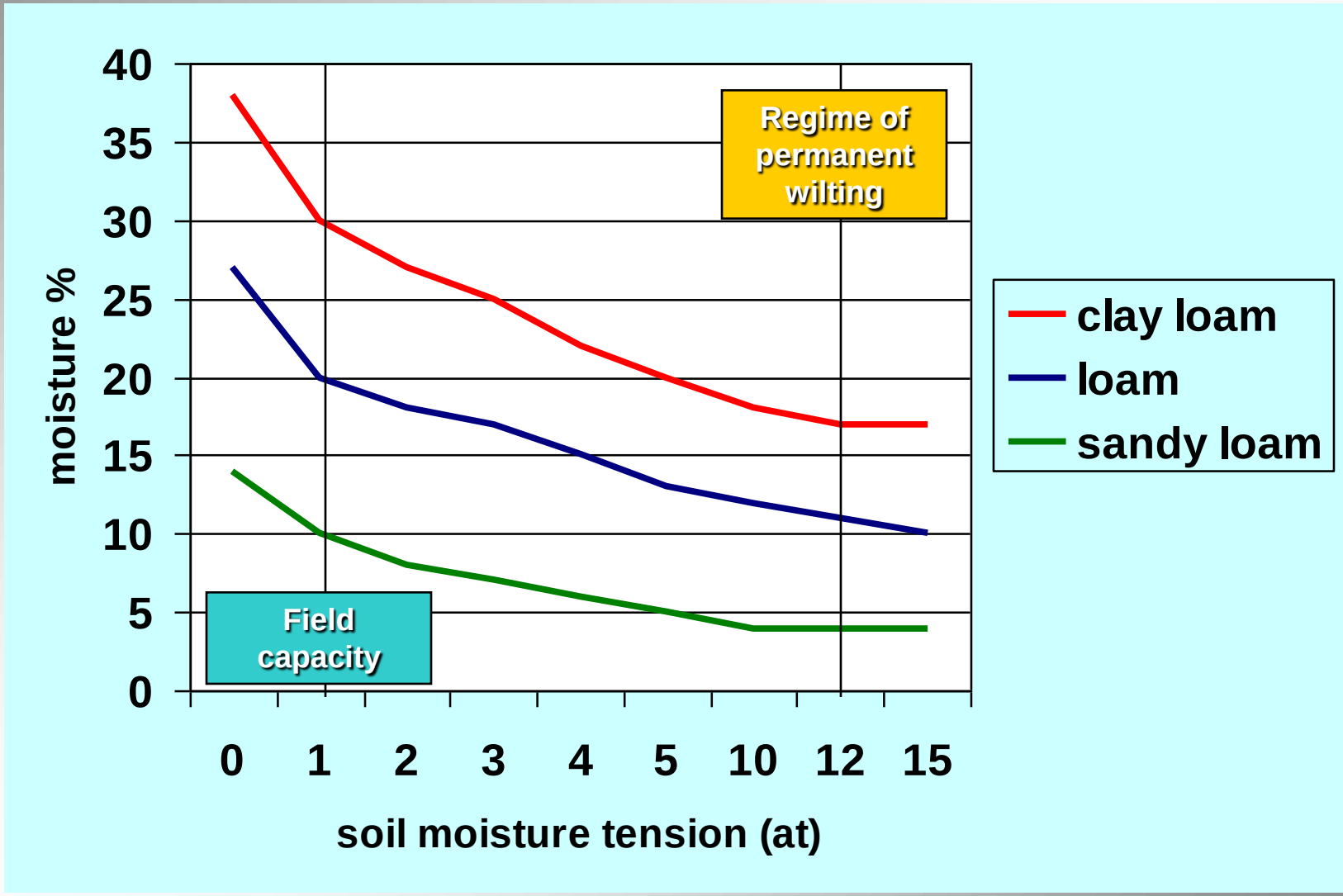
Water deficiencies of live systems trend from scarcity to drought. Drought is a physiological water stress causing irreversible changes in live structures.

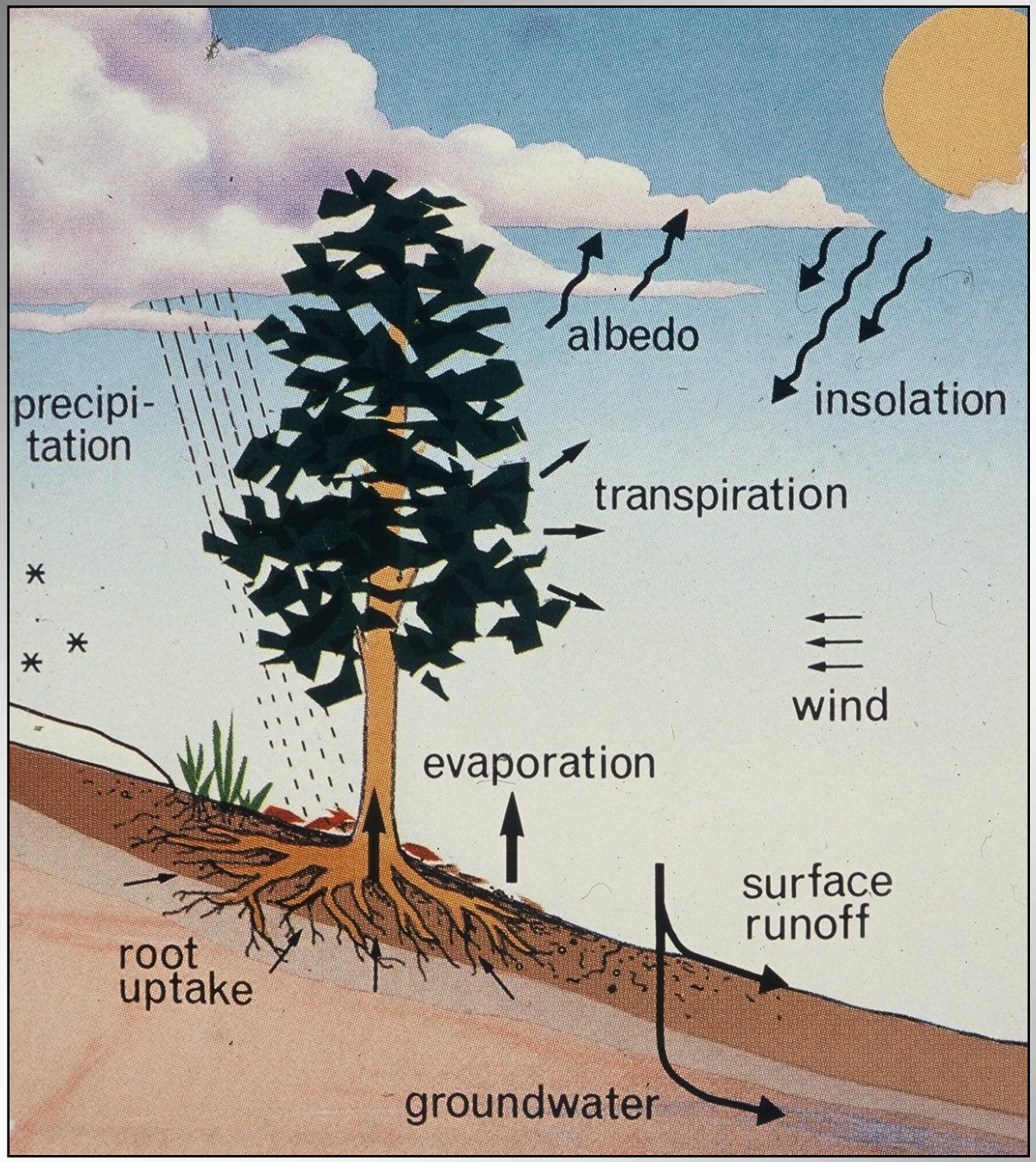
The identification of drought is rather complicated since water availability of any live systems can be assessed only by polifactorial methods. The present study focuses on drought processes and evapotranspiration trends regarding the major field crop species of Hungary.

Global water cycle



Water retain in soil





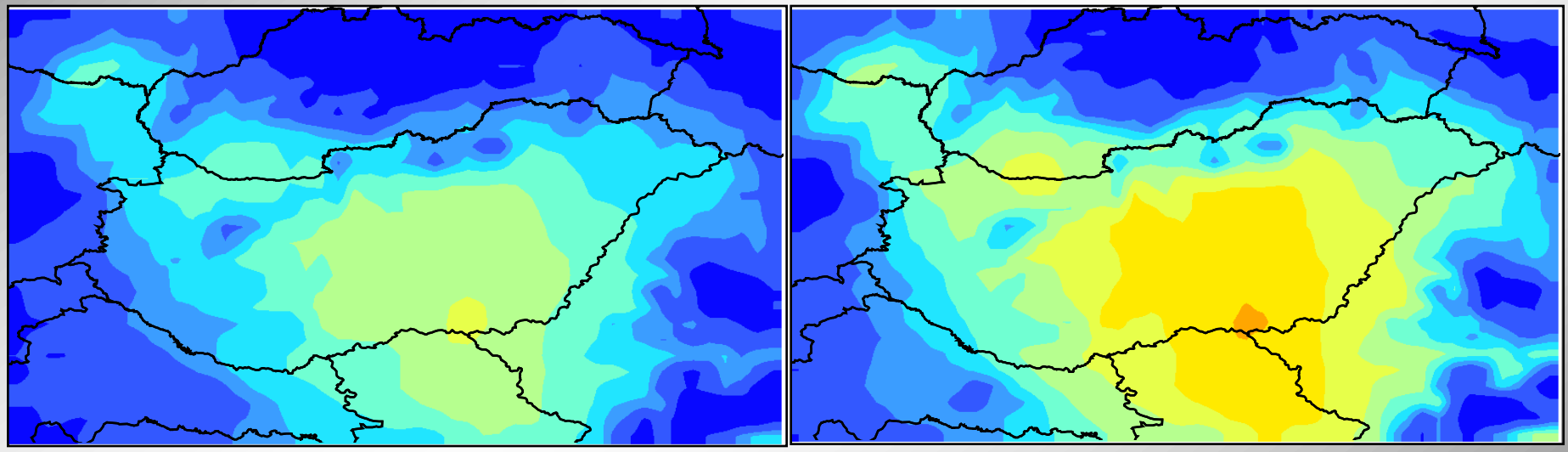
Water budget influencing factors and processes

Materials and methods

The assessment study aimed to evaluate and identify the main factors of drought in field crop species. In the survey databases of the Hungarian Meteorological Service and the Ministry of Rural Development have been used. The use of drought indices was based on the research results of the European ADAM project, evapotranspiration patterns of crop species have been determined due to evaluations of the national VAHAVA project.

In the study twelve crop species were involved (Sugar beet, spring and winter barley, winter wheat, maize, sunflower, field peas, potato, alfalfa, oil seed rape, rye and oats). Evapotranspiration, monthly water consumption data were compared to precipitation means, and monthly water availability budgets were identified. The modelling has been done at the SZIU Crop Production Institute.

Drought index projection for Hungary (1961-2030) based on IPCC A2 scenario



1961–1990

2001–2030

Results

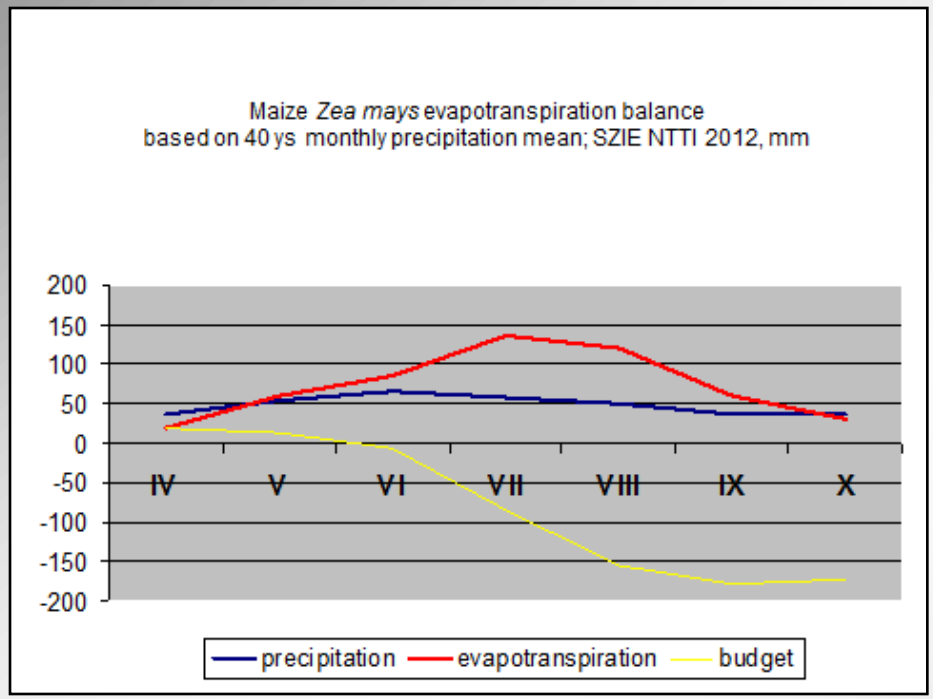
The results of the survey suggest, that drought is a multifactorial phenomenon that can be assessed by complex evaluations only. Drought is induced basically by the deficiencies of water input within an ecosystem, rainfall, temperature, soil water management characteristics highly influence physiological drought processes.

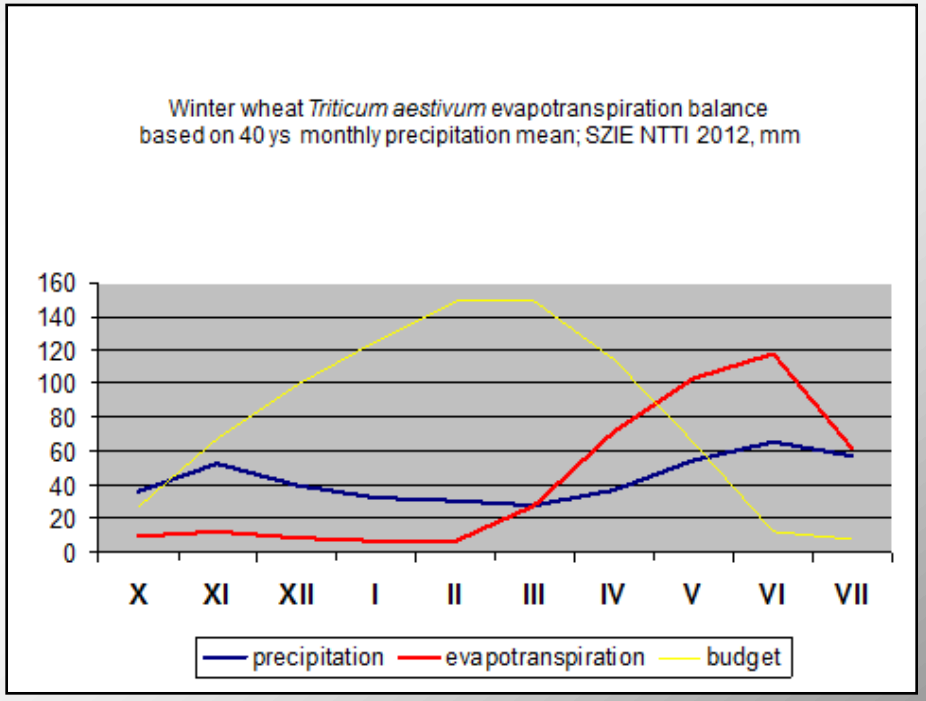
Monthly evapotranspiration patterns and water availability budget of field crop species (SZIU NTTI, 2012)

mm	evapotranspiration		Water availability		Critical water supply	
	min	max	min	max	best	worst
Alfalfa	14	95	-134	38	March	September
Barley S	16	106	-37	28	April	June
Barley W	8	112	29	168	March	May
Field peas	6	112	-8	119	March	July
Maize	18	135	-178	19	April	August
Oats	12	110	-26	39	April	June
Potato	14	128	-183	29	May	August
Rape	6	102	25	163	March	June
Rye	6	110	29	177	March	June
Sugar beet	12	122	-148	44	May	August
Sunflower	14	122	-47	100	May	August
Wheat	6	118	7	149	March	June

Field crop species respond to water availability in accordance with their life cycle and fenophases. The results obtained suggest, that the species respond in a diverse way to drought phenomena. *Winter crops* tend to have a positive water budget during most of their life cycle, however *spring crops* rely on precipitation prior to the vegetation period, or they would need additional water supply in form of irrigation.

Evapotranspiration patterns and water availability budget of maize and wheat crop (SZIU NTTI, 2012)





Conclusions

Evaluating water availability for field crops in relation with their evapotranspiration patterns, it can be stated, that field crop species respond in a diverse way to drought phenomena. Winter crops are more durable along their life cycle, however spring crops are more vulnerable during their vegetation period. In accordance with climate change scenario A2, increasing drought due to that may induce alterations in the cropping structure.


Thanks for your attention