Rizici od suše – DriDanube rezultati

Ksenija Cindrić Kalin
Državni hidrometeorološki zavod

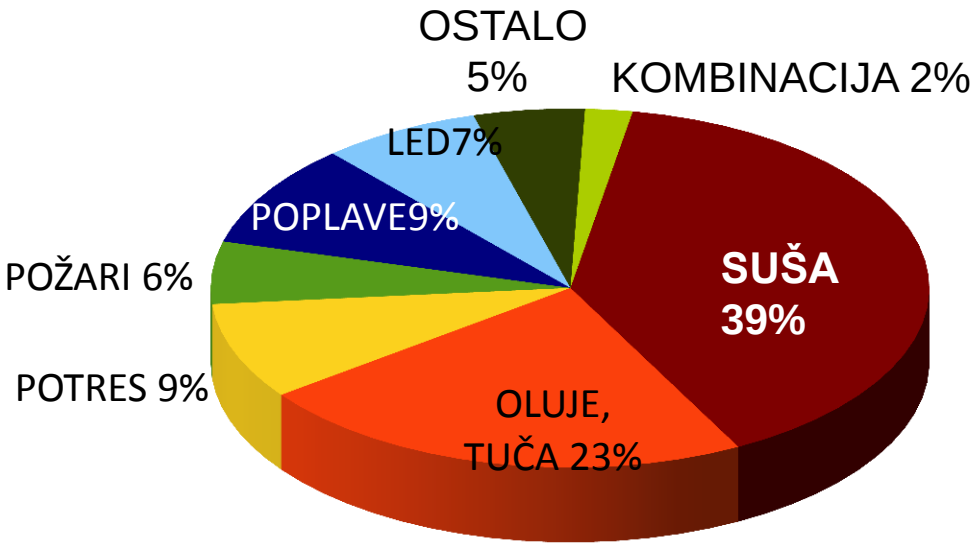
Nacionalna radionica, Zagreb, 3. prosinca 2018.

Project co-funded by European Union funds (ERDF, IPA)

- Procjena rizika u RH
- DriDanube procjena rizika 1
- DriDanube procjena rizika 2

Procjena rizika u RH

Ekonomski gubitci od elementarnih nepogoda u RH (MF, 1981-2012.)



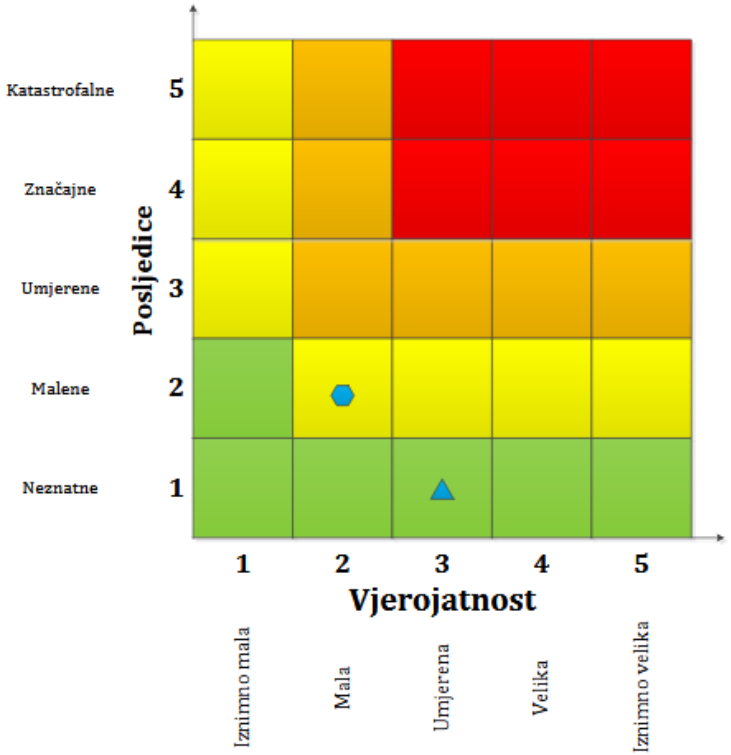
Ekstremne suše (2000.,2003.,2007.,2011/2012) uzrokovale su gubitke 70% do 90% *(Cindrić i sur. 2014)*

Poljoprivredni sektor najugroženiji: štete u usjevima, požari...

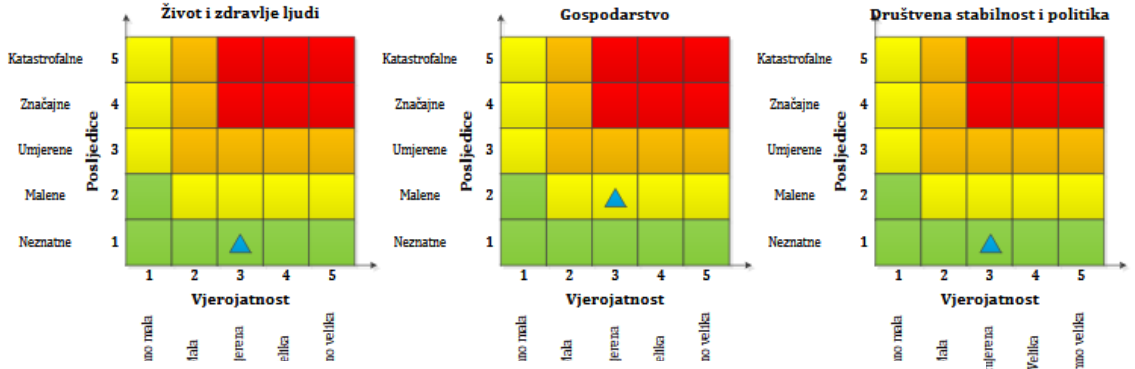
Izvor: DHMZ Bilten (2012)

Procjena rizika od katastrofa u RH (2015.) – uključena i suša

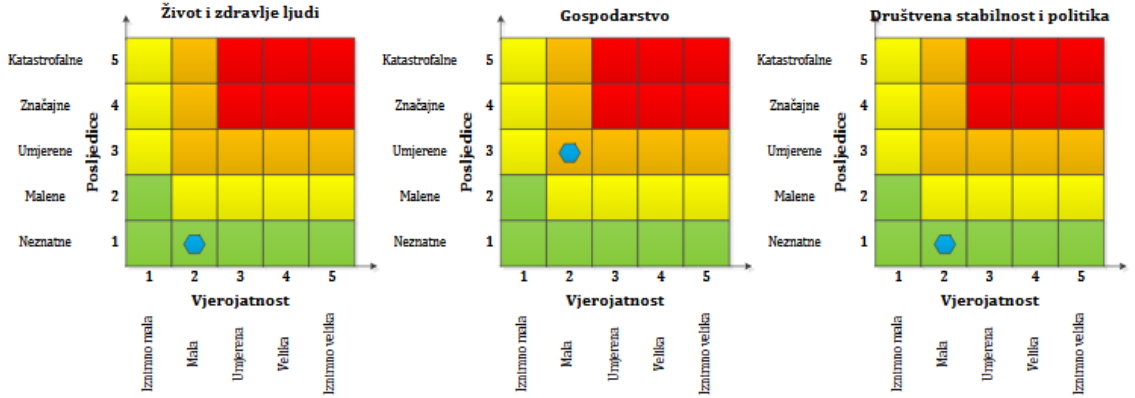
http://www.platforma.hr/images/dokumenti/Zavrsni_sazetak_2015_11.pdf



Najvjerojatniji neželjeni događaj



Događaj s najgorim mogućim scenarijem

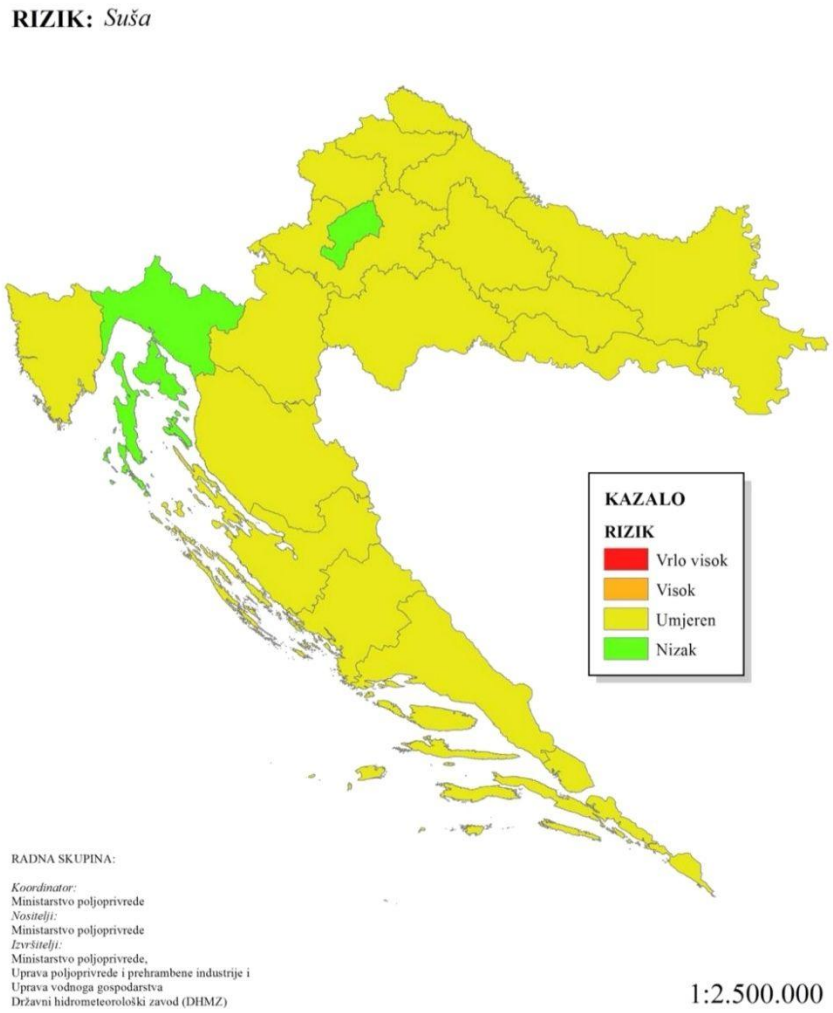


Život i zdravlje ljudi
Gospodarstvo
Društvena stabilnost i politika

	Vrlo visok rizik	Rizik se ne može prihvatiti, izuzev u iznimnim situacijama.
	Visok rizik	Rizik se može prihvatiti ukoliko je smanjenje nepraktično ili troškovi uvelike premašuju dobit.
	Umjeren rizik	Rizik se može prihvatiti ukoliko troškovi premašuju dobit.
	Nizak rizik	Dodatne mjere nisu potrebne, osim uobičajenih.

Suša na području Osječko-baranjske županije

PROCJENA RIZIKA OD KATASTROFA U REPUBLICI HRVATSKOJ



- Prevladavajući umjeren rizik od suše u RH

Visoka nepouzdanost procjene!

Tablica 6.10.-19. – Nepouzdanost rezultata procjene rizika

	Ne postoji dovoljna količina statističkih podataka, iskustva stručnjaka i ostalih podataka te pouzdana metodologija procjene posljedica zbog čega se očekuju značajnije greške.	
Vrlo visoka nepouzdanost	4	
Visoka nepouzdanost	3	X
Niska nepouzdanost	2	
Vrlo niska nepouzdanost	1	
	Postoji dovoljna količina statističkih podataka, iskustva stručnjaka i pouzdana metodologija procjene zbog čega je pojavljivanje grešaka vrlo malo vjerojatna.	

DriDanube procjena rizika 1

Training manual on drought risk assessment

➢ *Metodologija 1*

- Algoritam za procjenu rizika
- Priručnik
- Softver RED (Risk Estimation of Drought)

Mađarski meteorološki zavod

$$\hat{Risk}(\mathbf{s}) = \frac{1}{n}\sum_{t=1}^{n}\hat{L}\left(\mathbf{X}(\mathbf{s},t)\right) = \hat{P}_D \cdot \left(\left(\frac{1}{n-n_D}\sum_{SPI(\mathbf{s},t)\geq C_P}\hat{Y}\left(\mathbf{X}(\mathbf{s},t)\right)\right) - \left(\frac{1}{n_D}\sum_{SPI(\mathbf{s},t)<C_P}\hat{Y}\left(\mathbf{X}(\mathbf{s},t)\right)\right)\right)$$

Meteorological drought loss (hazard impact)

There are also some meteorological drought loss values that characterize the hazard impact of the drought quantitatively:

$$\mathrm{L}(\mathbf{s},t)=\mathrm{Loss}(\mathbf{s},t)$$

These loss values may be absolute values in weight or relative ones in percent.

Meteorological drought loss (hazard impact) function

The loss value $\mathrm{Loss}(\mathbf{s},t)$ itself is a random quantity because it depends also on the outcome of the meteorological random variables $\mathbf{X}(\mathbf{s},t)$. Therefore we can define the meteorological drought loss (hazard impact) function,

$$L\left(\mathbf{X}(\mathbf{s},t)\right) = \mathrm{E}\left(\mathrm{Loss}(\mathbf{s},t)\,\middle|\,\mathbf{X}(\mathbf{s},t)\right) \qquad (4)$$

that is the conditional expectation of the meteorological loss given the meteorological variables, or with other phrase it is the regression of $\mathrm{Loss}(\mathbf{s},t)$ on $\mathbf{X}(\mathbf{s},t)$.

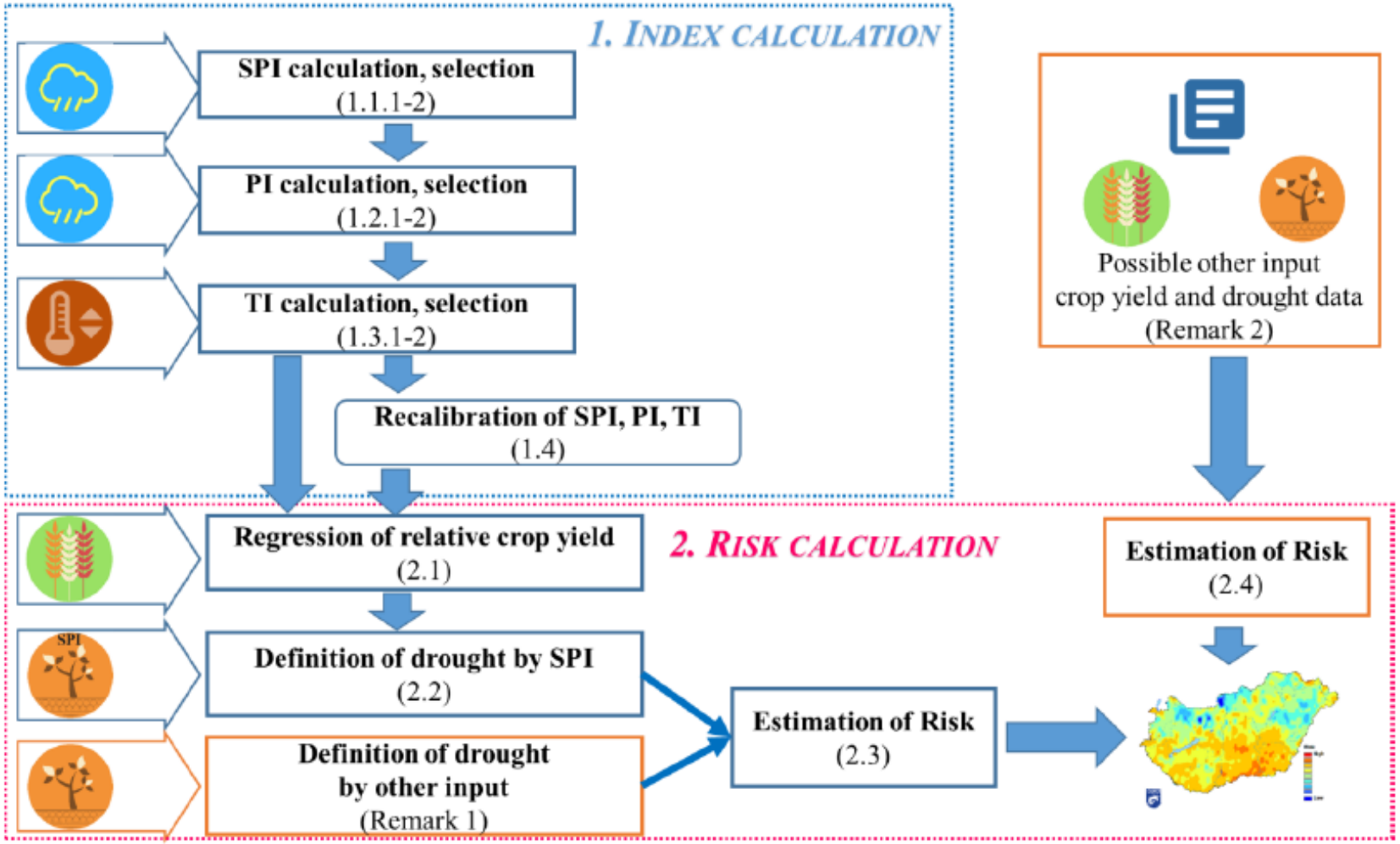
Meteorological drought risk

According to the mathematical definition the risk is the expected value of the loss i.e.,

$$Risk(\mathbf{s}) = \mathrm{E}\left(\mathrm{Loss}(\mathbf{s},t)\right) = \mathrm{E}\left(L\left(\mathbf{X}(\mathbf{s},t)\right)\right) \qquad (5)$$

and it is equal also to the expected value of the meteorological loss function as a consequence of some mathematical theorems. It can be assumed that the risk values depend on the locations only.

➢ *Metodologija 1*



Algoritam za procjenu rizika

➢ *Metodologija 1*

i) Meteorološki podaci

ii) Podaci o prinosima

- Procjena funkcije relativnog prinosa (matematički algoritam)
- Standardizirani oborinski indeks (SPI)
- Procjena rizika

➢ **RED** (**R**isk **E**stimation of **D**rought)

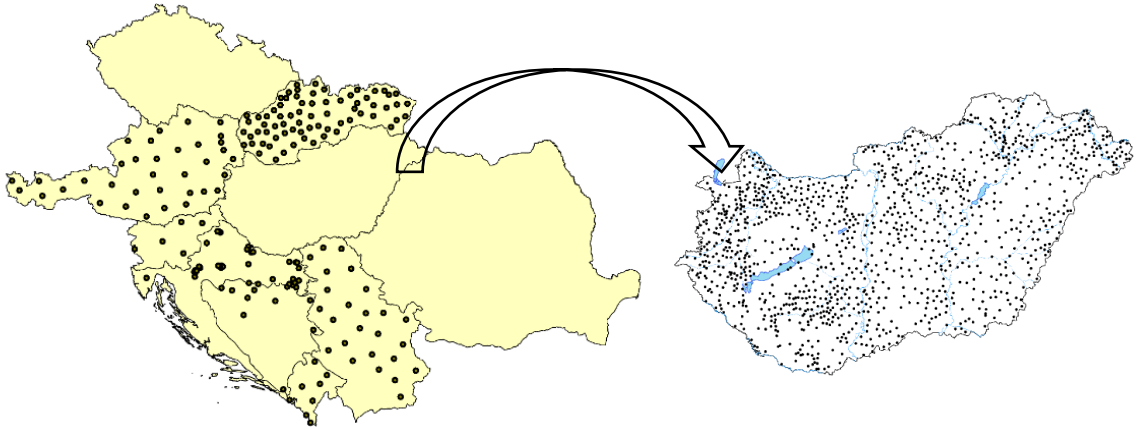


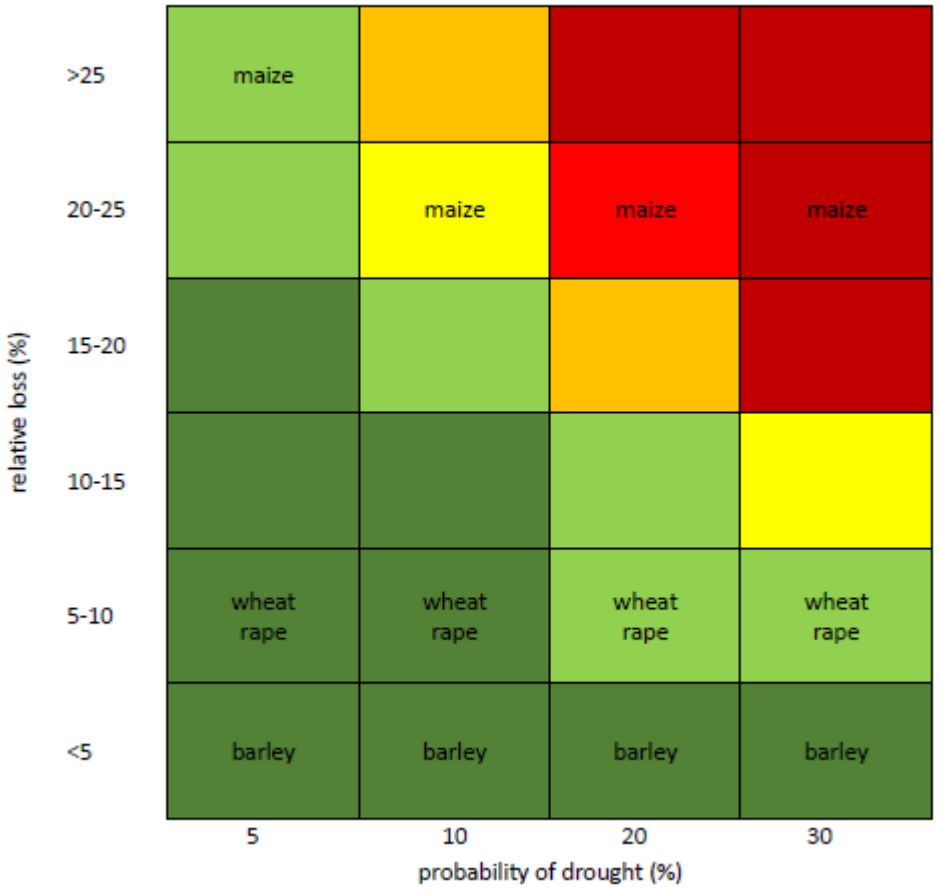
Figure 2 Yield data in Hungary

	Maize	Wheat	Barley	Rape	Oats	Sunflower	Sugar Beet	Potatoes	Pear	Apple	Plum	Citrus	Grape	Olive	Cabbage
Austria	X	X	X	X	X	X	X	X		X			X		
Bosnia and Hercegovina	X	X	X		X										
Czech Republic															
Croatia	X	X	X	X		X									
Hungary	X	X	X	X		X									
Montenegro	X	X						X	X	X	X	X	X	X	
Romania															
Serbia	X	X	X	X		X									
Slovakia	X	X	X	X		X	X	X							
Slovenia	X	X						X		X			X		X

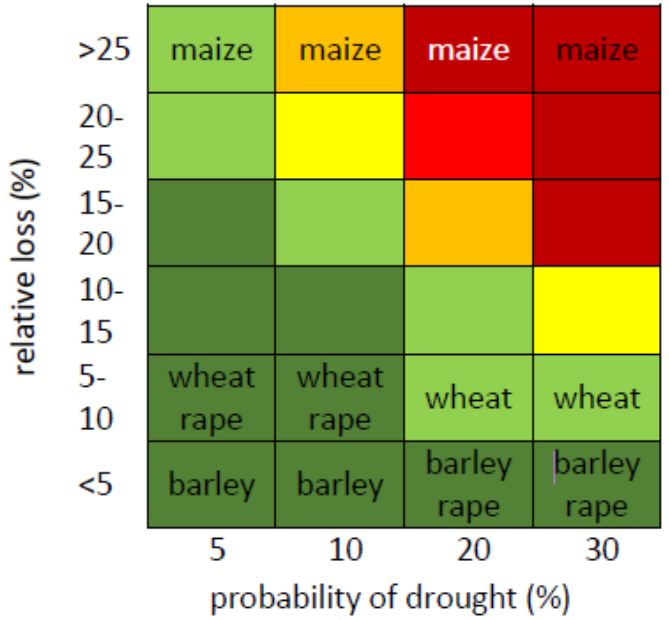
Table 1 Yield data per countries

➢ *Metodologija 1*

Matrica rizika za dunavsku regiju



Matrica rizika za RH

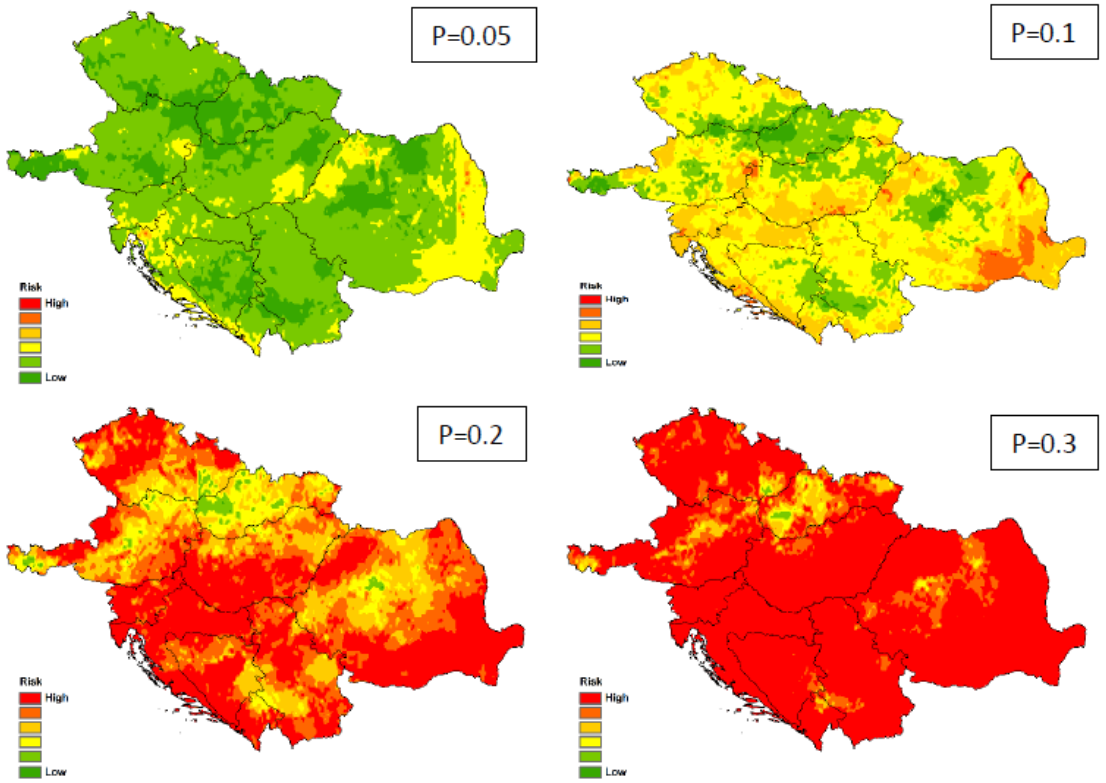


Croatia

➢ *Metodologija 1*

Karte rizika za dunavsku regiju

Kukuruz



Ječam

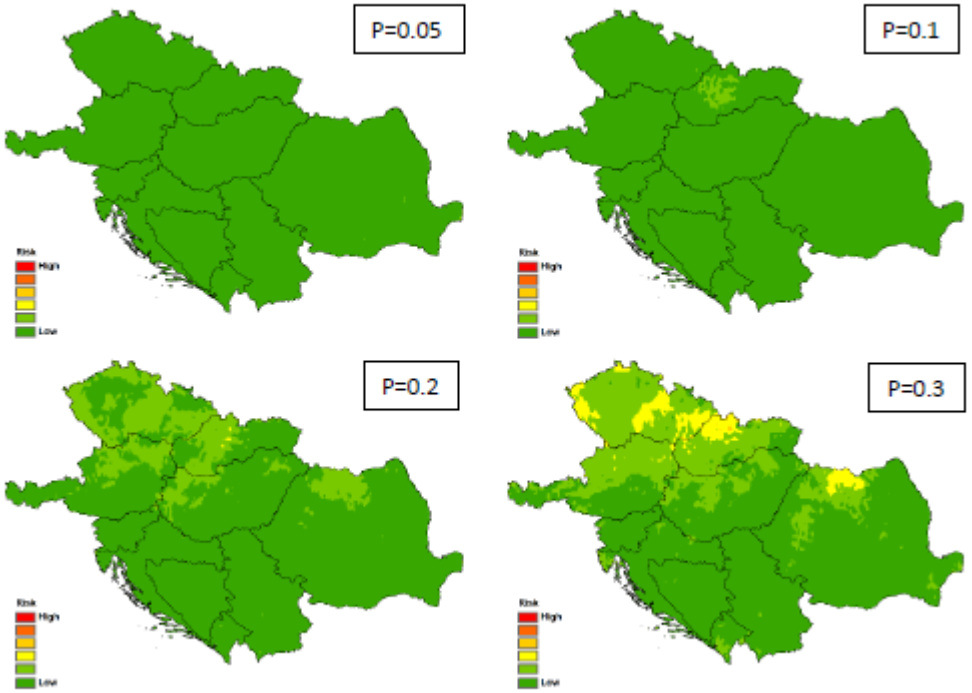


Figure 5. Risk maps for barley on different drought probability levels (P)

➢ *Metodologija 1*

Karte rizika za dunavsku regiju

Pšenica

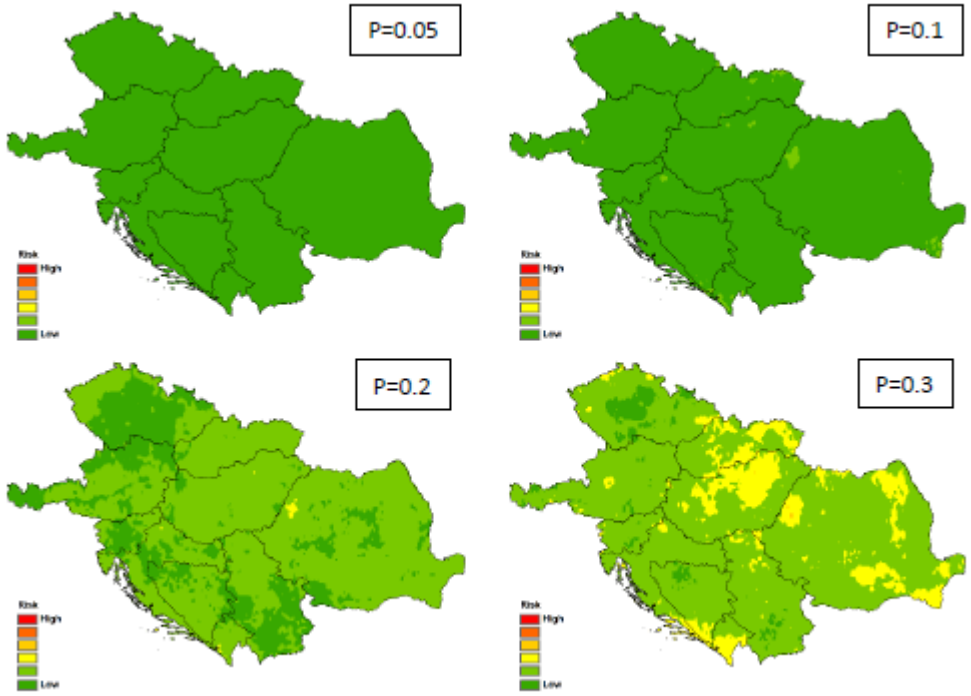
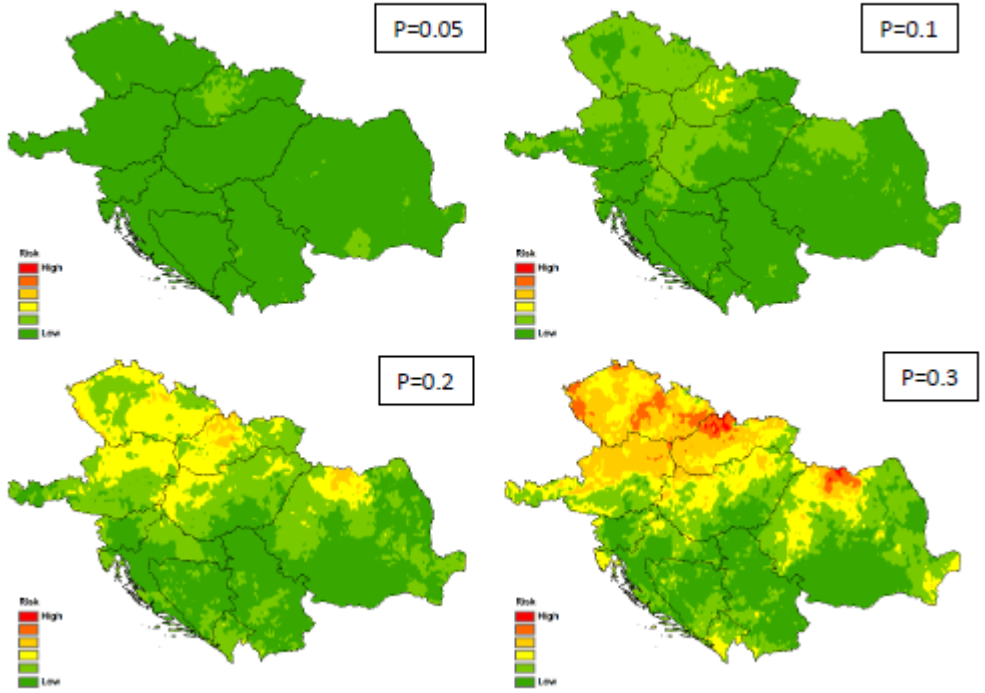


Figure 6. Risk maps for wheat on different drought probability levels (P)

Repica



➢ *Metodologija 2*

Sušna razdoblja

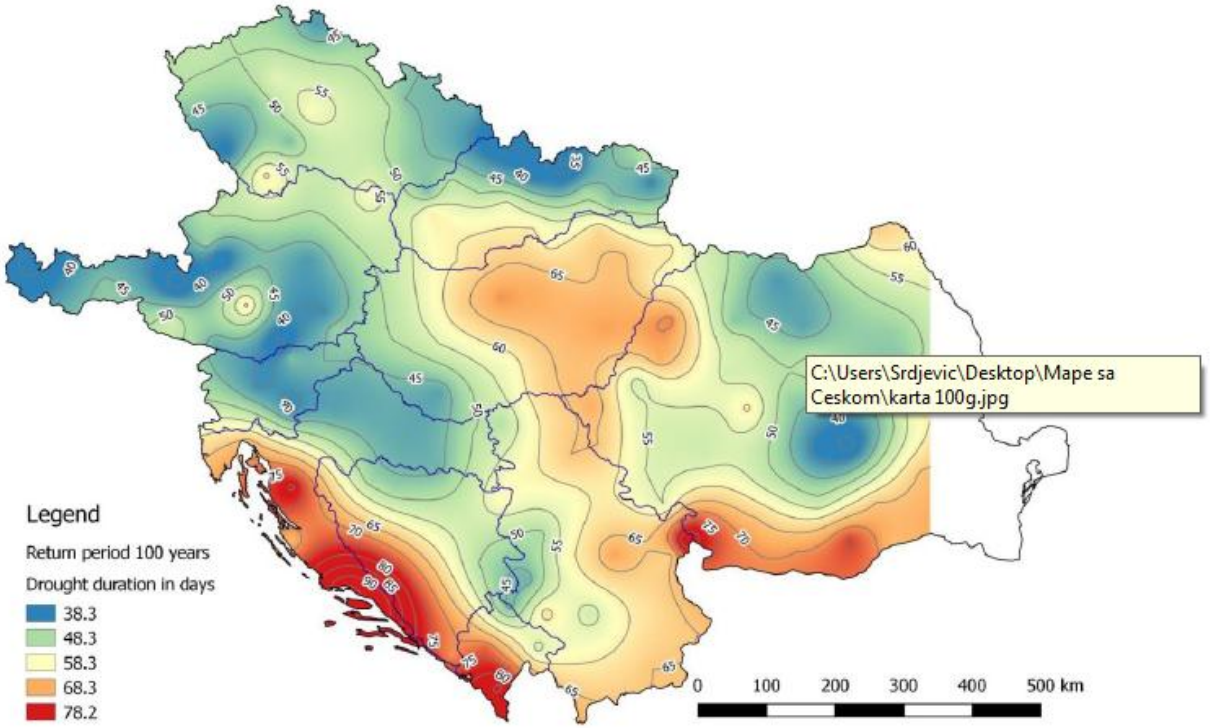
Zelenhasić – Todorović metoda za procjenu rizika

Stohastički model za procjenu ekstremnih sušnih razdoblja (SR) na pojedinoj lokaciji:

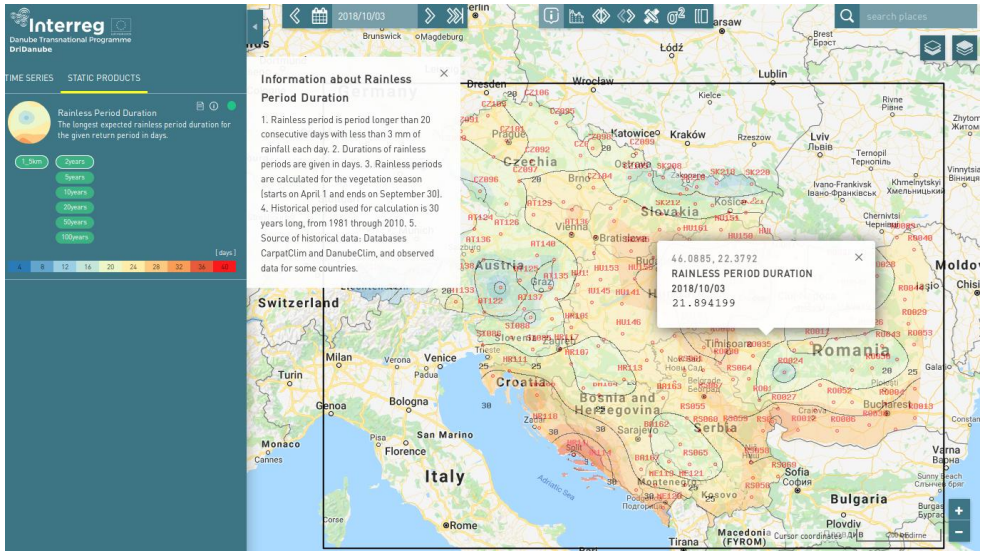
- SR – najmanje 20 uzastopnih dana s dnevnom količinom oborine manjom od 3 mm
- vegetacijsko razdoblje 1. travanj – 30. rujan
- na nizove SR prilagođava se Poisoonova teorijska razdioba
- metoda sadrži glavne komponente suše – trajanje, početak, broj događaja i najdulja trajanja – omogućuje procjenu povratnih vrijednosti za različite povratne periode

Partner country	Number of points	Source of daily rainfall data
Austria	19	Missing information
Bosnia and Herzegovina	6	DanubeClim
Czech Republic	17	Missing information
Croatia	12	Observed data
Hungary	22	CarpatClim + DanubeClim
Montenegro	4	DanubeClim
Romania	43	CarpatClim
Serbia	20	CarpatClim + DanubeClim
Slovakia	22	CarpatClim
Slovenia	5	Observed data

➢ *Metodologija 2*



Statički produkti u DUS-u



Očekivana trajanja sušnih razdoblja za T= 100 godina

T = 2, 5,10, 20, 50,100 godina