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DROUGHT SEVERITY AND ITS EFFECT ON AGRICULTURAL PRODUCTION IN THE HUNGARIAN-SERBIAN CROSS-BORDER AREA

Károly Fiala[1*], Viktória Blanka[2], Zsuzsanna Ladányi[2], Péter Szilassi[2], Balázs Benyhe[1], Dragan Dolinaj[3], Imre Pálfai[1]

[1] Lower-Tisza Water Directorate, Stefánia 4, H-6720 Szeged, Hungary
[2]Department of Physical Geography and Geoinformatics, University of Szeged, Egyetem u. 2-6, H-6722 Szeged, Hungary
[3] Climatology and Hydrology Research Centre, Faculty of Science, University of Novi Sad, Dositeja Obradovića 3, 21000 Novi Sad, Serbia
*Corresponding author, e-mail: FialaK@ativizig.hu

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Abstract
Several environmental and economic consequences of drought and the accompanying water shortage were observed in the plain area of the Carpathian Basin in the last decades. This area is mostly used for agriculture, thus it is a key problem in the future to maintain food safety in the changing circumstances. Therefore, involvement and identification of areas affected by drought hazard and revealing steps of efficient adaptation are of high importance. In this study influence of drought severity on agricultural production is investigated in the Hungarian-Serbian cross-border area. The tendency in drought severity was analysed by PaDI and MAI drought indices. The effect of drought on agricultural production is evaluated on maize yield data as the most drought sensitive crop in the region. Increasing drought frequency and severity was indicated for the study area for the period of 1961-2012. The spatial assessment of annual PaDI maps revealed the higher exposure of the north and north-eastern part of the study area to drought, where drought frequency was also experienced to be the highest. Increased sensitivity was detected based on maize yield loss after the early 1990s and annual yields were in strong connection with drought severity. In spite of the technological development of agriculture, environmental factors still substantially affect crop yields. The observed unfavourable changes in the region mean that water management and spatial planning faces conceptual challenges to prevent and mitigate the damages of drought.

Keywords: climate change, drought, PaDI, agriculture, yield loss

INTRODUCTION

Drought is one of the most important environmental hazards in Southern and Eastern Europe. The lack of water during drought periods have effect on many sectors (e.g. agriculture, energy production, industrial water use, health care, tourism) (Warrick et al., 1975; Maracchi, 2000; Svoboda et al., 2002; Zeng, 2003; Lei et al., 2011; Ye et al., 2012; Lin et al., 2013 Wisner et al., 2004) and also on ecology (Poiani et al., 1995, Winter, 2000, Parmesan, 2003, Normand et al., 2007, Beierkuhnlein et al., 2011, Pitchford et al., 2012).

Drought is a complex phenomenon influenced by the quantity and temporal distribution of precipitation, temperature, air humidity etc. In Hungary, due to climate change a 0.8°C rise in surface temperatures and a 60–80 mm decrease in precipitation were detected in the Carpathian Basin in the last century (Rakonczai, 2011) and increasing rate and occurrence of drought was described in the last decades (Bihari, 2006; Bartholy et al., 2007). Spasov et al. (2002) also reported that drought is also a quite often natural hazard in Serbia; dry years were particularly frequent in the last two decades of the 20th century. The strength of drought in South-eastern Europe shows different spatial distribution year by year. The map constructed from the 10% probability of Pálfai Drought Index (PaDI) occurrence showing the spatial pattern of drought inside the South-Eastern Europe (SEE) region (Pálfai and Herceg, 2011) clearly confirms the fact that the Hungarian-Serbian cross-border area is seriously affected by drought.

In the last decades several environmental and economic consequences of drought and the accompanying water shortage were observed in the plain area of the Carpathian Basin. Environmental consequences of drought are the decreasing groundwater table (Major and Neppel, 1988; Szalai, 2011; Rakonczai et al., 2012), reduction surface water cover (Kovács, 2008), alteration of soil properties (Ladányi et al. 2009; Puskás et al., 2012) and vegetation changes (Biró et al., 2008; Molnár et al,. 2008; Ladányi et al., 2010). The Great Plain is highly important in agricultural aspects for its countries, since it is mostly covered by high fertility soils and the fields are used as arable lands. Droughts stress due to water scarcity and heat waves cause significant yield loss. In drought years, 40-50% loss is observed in the southern Great Plain, and in plot scale, total crop loss is experienced.

In spite of the dramatic technological development of agriculture (e.g. irrigation systems, new seeds for sowing, genetic modification), environmental factors such as climate, ecology and soil attributes still substantially affect crop yields. It is a key problem in the future to maintain food safety in the changing circumstances, therefore involvement and identification of areas affected by drought hazard and revealing steps of efficient adaptation are of vital importance. In this study the influence of drought severity on agricultural production is investigated in the Hungarian-Serbian cross-border area of the SEE region. Drought severity is calculated by two indices mostly used in Hungary and Serbia, and its effect on agricultural production is evaluated.

STUDY AREA

The study area, South Hungary and the plain areas of Vojvodina, is situated in the southern part of the Carpathian Basin (Fig. 1). Similar physical-geographical features describe the area, where annual mean temperature is around 11 °C and the annual amount of precipitation is between 500-600 mm. In July the mean temperature is around 21 °C and 23 °C, the precipitation in the summer half-year is at about 300 mm (Smailagic et al., 2013; OMSZ, 2014). The dominant soil type is chernozem and its subtypes both in the Hungarian and the Serbian areas; furthermore meadow and sandy soils can also be found. The dominant land use type in the area is arable land based on Corine Land Cover 2006, thus the effect of drought on the agricultural production has high importance on the economy of the region.

METHODS

Calculation of drought severity

Meteorological factors play a significant role in the formation of drought, thus by their assessment, drought severity can be quantified. Pálfai Drought Index (PaDI) (Pálfai and Herceg, 2011) and the Moisture Availability Index (MAI) (Hargreaves, 1975) were used to describe droughts of the past decade for the right bank-side catchment of Tisza and in Vojvodina.

The PaDI uses monthly temperature and precipitation data for the calculation and it characterises the drought with one numerical value that is associated with one agricultural year. The index is calculated as follows:

$$PaDI = \frac{\left[\sum_{i=apr}^{aug} T_i\right] / 5}{\sum_{i=oct}^{sept} \left(P_i * w_i\right)} * 100 * k_t * k_p * k_{gw}$$

where T_i is the mean monthly temperature from April to August, P_i is the monthly sum of precipitation from October to August, w_i is a weighting factor expressing

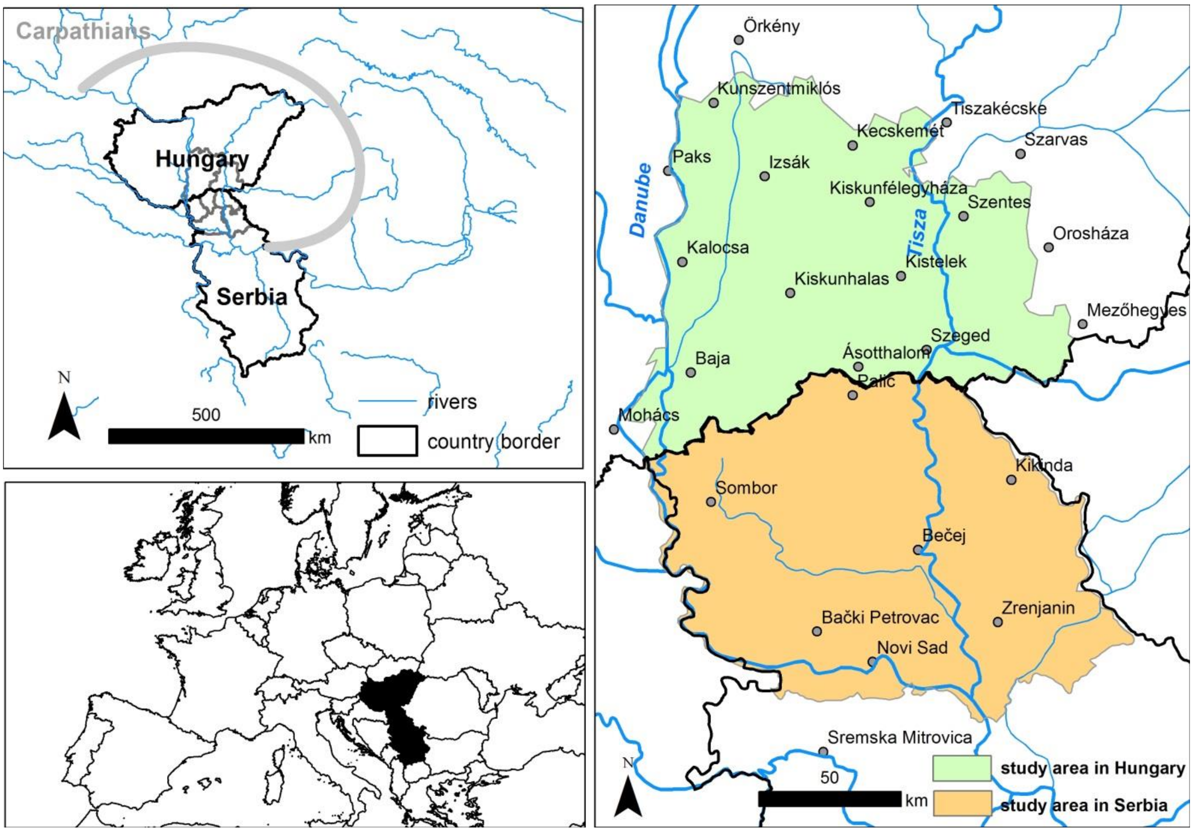

Fig. 1 Location of the study area and the meteorological stations

the importance of the months in the evolution of drought, while k_t, k_p, and k_{gw} are correction factors assessing the temperature, precipitation and groundwater conditions in the preceding years.

PaDI was calculated for each year in the period of 1961-2012. The tendency in drought severity was analysed by dividing the full period into two parts (1961-1987 and 1988-2012) calculating the average index value for both period. The changes of drought frequency were analysed by yearly drought index based on the average value of all stations. Spatial analysis of drought severity was also carried out by producing drought maps for each year.

The Moisture Availability Index (MAI) is a relative measure of the adequacy of precipitation in supplying moisture requirements (Hargreaves 1975). The MAI is suitable to evaluate the climate resource for agricultural production. The index is the ratio between monthly precipitation and reference evapotranspiration and this takes into account water requirements too (Hargreaves and Keller 2005). The MAI can be calculated at different time scales (monthly, seasonal, and annual). The MAI is calculated as:

$$MAI = \frac{AE}{PE}$$

where AE is the actual evapotranspiration and PEis the potential evapotranspiration.

Analysis of the effects on agricultural production

For analysing the effect of drought on agricultural production maize yield data were evaluated as the most drought sensitive crop in the region. To assess the spatial differences in yield loss, county level yield data were used for Hungary in the year 2012, which was the most recent serious drought in the region. The rate of yield loss compared to the mean value of the 2000-2012 was calculated in percentage for each Hungarian county.

In the study area the yearly anomalies of maize yield between 2000 and 2009 were calculated and compared to the mean value of the 2000-2012 for the south-eastern Hungarian counties (Bács-Kiskun and Csongrád) and for Vojvodina to assess the effect of drought in the different years and to identify the years when yield loss was significant. Moreover by the analysis of the data of the two countries, it can also be identified, whether the variability of yield is similar in both countries, meaning that the changes are irrespective of the different cultivation practices.

Finally the yearly yield data were compared to the yearly PaDI values between 1961 and 2012 to reveal the connection between the drought severity and maize yields.

RESULTS

Analysis of past and present droughts

Analysis of Pálfai Drought Index in the study area

Based on the calculated Pálfai Drought Indices (PaDI) drought severity show increasing tendency in the region. A significant increase of the average PaDi value was observed between the two analysed period (1961-1987 and 1988-2012) on nearly all stations (Fig. 2). In the first period the average PaDI values varied between 4 and 5.5 °C/100 mm. The highest average value was observed on northern part of the area (Örkény station), while the lowest average value was detected on the southern part (Bečej station). In the second period PaDI values varied between 4.6 and 7.1 ° C/100 mm. In this period the drought severity was higher in the eastern part of the area, the highest average value occurred on north-eastern part (Tiszakécske) also in this period. The highest increase between the periods was identified and Tiszakécske station (north-eastern part), where PaDI value increased by 2 °C/100 mm, while a slight decrease in drought severity was observed at one station (Paks on the western part).

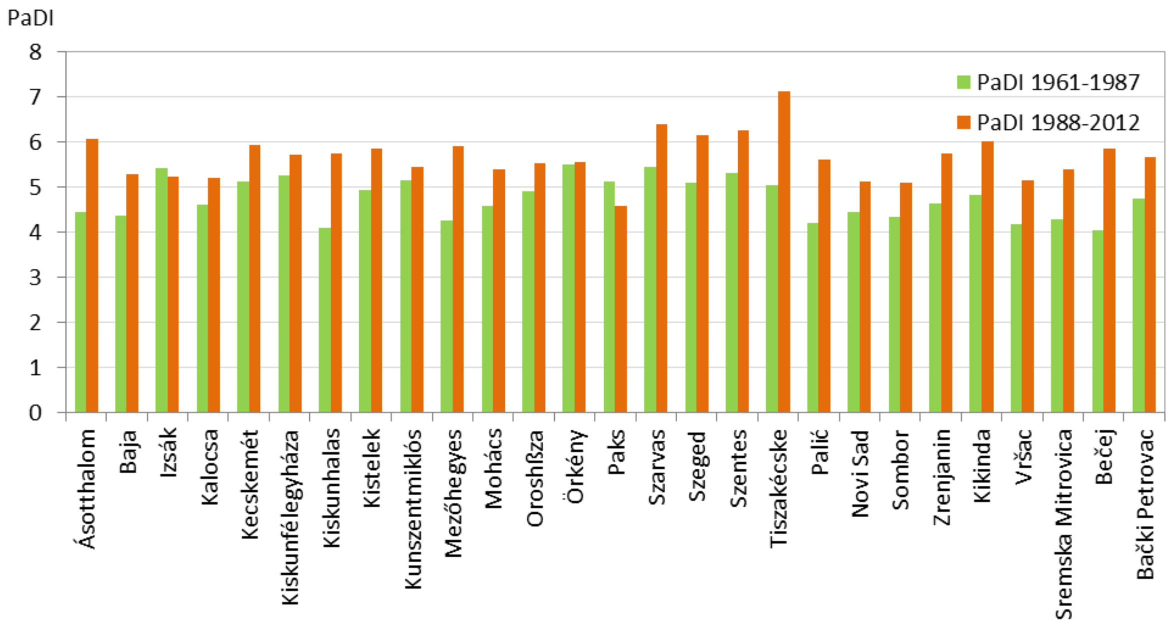

Fig. 2 Changes of PaDI mean values in the studied stations in Hungary in the two partial periods

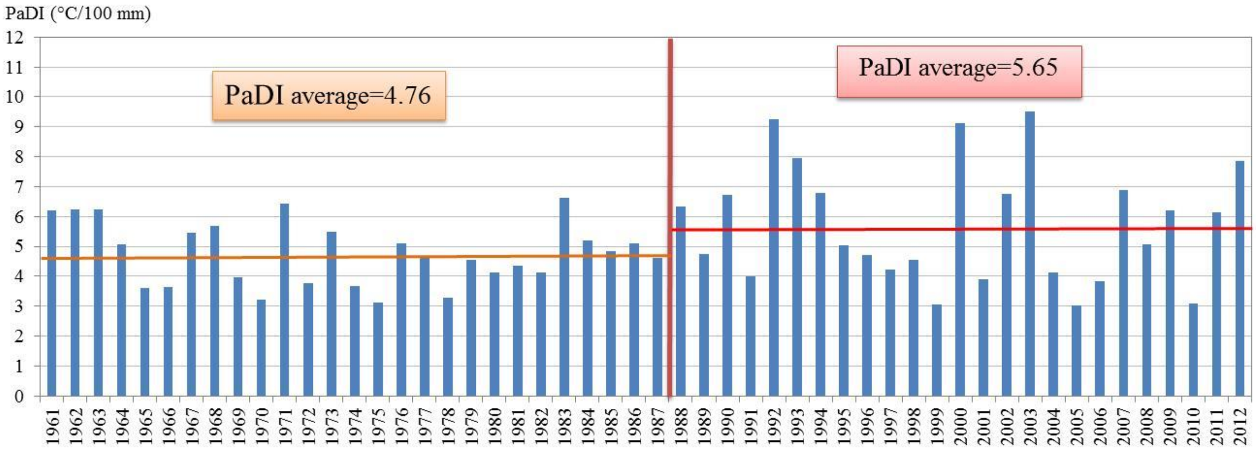

Fig. 3 Mean PaDI values at the studied stations between 1961 and 2012

Drought severity can be defined by the degree of water scarcity, though sometimes this parameter is not considered appropriate for the affected sectors. Agriculture, ecology, industry and society have completely different water needs. Because of these various needs this question can be approached with reference to the average precipitation of the affected area. Precipitation amounts compared to the long-term average are suitable to describe the water shortage. Several researchers dealt with this issue (e.g. Szalai, 2009; Bartholy and Pongrácz, 2005) and maps of the areas with water deficiency were produced. According to these studies, water deficiency is between 100 mm and 200 mm in drought periods on the catchment area, which could be even higher in extreme circumstances. The problem can be increased when drought occurs on the same area for consecutive years since water shortage becomes more and more pronounced if no significant water refill is taken place.

Besides drought severity, frequency also has to be assessed to assess the importance of drought problem in the area. For assessing drought frequency regional averages were calculated for each years based on data of all stations. Fig. 3 shows that not only severity, but frequency also increased. In the first period (1961-1987), the annual drought index had reached the value of 6 °C/100 mm only in 5 years (moderate drought) in the 27-year long period. The most severe drought occurred in 1983, when the PaDI value was 6.6, which also means only moderate drought.

A more considerable change could be observed in the second period (1988-2012). Drought years occurred more frequently, the annual drought index exceeded the value of 6 °C/100 mm in 12 years in the 25-year long period. Moreover in this period more serious droughts occurred than in the first period. Heavy droughts also evolved in the region, PaDI value exceeded the value of 8 °C/100 mm in 3 years. The most severe drought occurred in 2003, when the PaDI value was 9.5 °C/100 mm. Data have pointed out that the area is affected at least by moderate drought in every 2 years, and heavy droughts are also recorded, causing serious damages. Beside the increasing severity, the variability of droughts between the years was also higher in the second period. The lowest PaDI value of the whole studied period (1961-2012) occurred in the second period.

In the studied region, considerable spatial differences can also be observed. Drought sensitivity is quite different, thus areas can be allocated where drought years occurred more frequently. Drought occur most frequently on the northern, north-eastern part of the study area, thus this area is the most effected. The average drought severity, calculated for the two periods, also indicated this area as the most affected.

Obviously, consecutive years differ from each other; therefore the spatial pattern of drought severity is different from year to year. Some characteristic example of the spatial differences is shown on Fig. 4. In 1983,

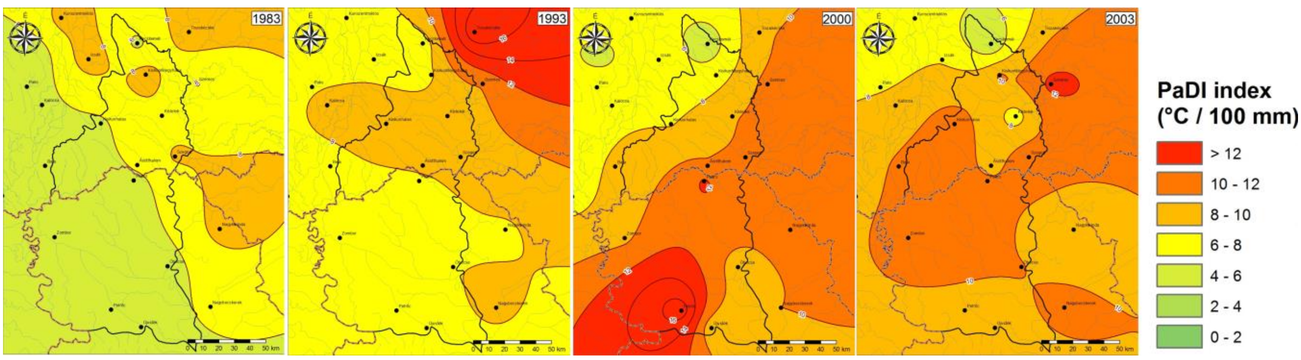

Fig. 4 Distribution of PaDI values in 1983, 1993, 2000 and in 2007 (4-6: slight drought; 6-8:moderate drought; 8-10: heavy drought; 10-12: serous drought; 12-14: very serious drought; >14: extreme drought)

which was the most severe drought year in the period of 1961-1987, the north-eastern part of the area was more affected. This drought was evolved due to the warmer weather from winter to August and this warm period was associated with precipitation lower than average in almost every months. The dry autumn and snowless winter of the year 1989 contributed to the formation of droughts for the next years. In 1990 the low level of groundwater, followed by a hot July and August with no rainfall, resulted in huge losses in maize yield. The same causes could be determined the development of drought in 1992 and 1993 with similar severity to that of 1990. Based on the temperature data for 1992, the annual mean temperature for the April-August period was 18.8°C, which was not extreme, however the mean monthly temperature in August exceeded 25 °C, which meant new records since observations. The number of heat days in the three summer months was over 37 days, which is twice as much as the average value. The last quarter of the previous year precipitation exceeded the long-term average. After December, the monthly sums were below the long-term average, except June. During the warmest period there was no precipitation, the dry period without precipitation was more than 30 days on the affected area. The PaDI values were between 11-14 °C/100 mm.

The drought in 2000 was preceded by huge inland excess water inundations as a result of the precipitation in November and December in 1999, which was twice the amount of the average precipitation of these months. January and February was characterised by few precipitation, and then March and April were slightly more humid. However, after 7th April, an extremely long dry period started lasting until the first week of July then it went on after a short break. 216 mm precipitation was recorded for the whole calendar year in Szeged. Most stations in the Danube-Tisza Interfluve measured less than 300 mm. The precipitation did not reach 60 mm from April to August. The number of heat days was extremely high. These both contributed to severe drought, PaDI values exceeded 10 °C/100 mm (Fig. 4). The drought affected the area of Vojvodina much more seriously, here the PaDI values reached 12-14 °C/100 mm.

Prior to the drought in 2007, the area was affected largely by inland excess water inundations and a record-size flood in 2006. In spring time of 2007 water scarcity could be expected since a long arid period was experienced in the autumn and winter of 2006. The 3-month precipitation sum was only half of the long-term average. Besides these, winter months were unusually warm. The monthly mean temperature was around 4–5°C, while the long-term average is -1-1.5°C. Accordingly, evaporation was higher, which further increased the water shortage. An average amount of precipitation fallen at the beginning of spring, and then in April hardly any rain could be measured. The situation slightly moderated during the period starting in May defined by heavy rains, however, serious drought evolved as the summer heat arrived. The daily maximum temperature from mid-July exceeded 36°C. There were 50-60 heat days on the Great Hungarian Plain. The precipitation was half of the long-term average. Precipitation further decreased in August – one third of the amount typical for the area fell, which resulted in extreme drought (Fig 4). In 2007 moderate and mild drought could be observed in Vojvodina according to the values of Pálfai Index.

The most severe drought of the past 50 years evolved in 2012. Considering the national average, scarcely more than 400 mm precipitation was measured in 2011, which is two-thirds of the long term average. The annual precipitation was 325-400 mm in the study area (Fig. 4). The dry period continued in the first half of 2012. The precipitation on the catchment area was 30% less, while at certain places there was a decrease of 50% compared to the long-term average. On average, 225 mm precipitation was recorded until August (only about 5 mm fell in August), while the long-term average was 380 mm. The entire catchment area, especially the NE part of the area, was extremely dry (Fig. 4). The extremely high temperature in July and August intensified the unusual aridity. The monthly mean temperature was 3-4°C over the long-term average and there were 60 heat days in this year. Due to the superponation of the extreme weather elements, extreme and severe droughts developed on 80% of the catchment area.

Further analysis of drought indices in the Vojvodina part of the study area

Dry years were particularly frequent in the last two decades of the 20th century in Serbia as well (Spasov et al., 2002; Gocic and Trajkovic, 2013). Gocic and Trajkovic (2014) allocated North Serbia as a region with precipitation values under the average value of Serbia. The demonstration of the results was based on the meteorological station Rimski Sancevi, which is located 15 km from Novi Sad, because its statistics are exceedingly similar to the average meteorological values throughout Vojvodina. Measuring precipitation throughout critical months such as July and August for the period of 88 years (1924-2012) shows that 84.27% of the years July, and 84.27% of the years August were arid. The amount of the precipitation evidently was not sufficient to satisfy crop water requirements, which was above 100 mm from June to August (Table 1). The moisture Availability index (MAI) in the region very low, particularly in August (Table 2), and there are some spatial differences (Table 3). Regions where MAI index is under 0,33 are very deficient, 0,34-0,66 moderately deficient, 0,67-0,99 somewhat deficient, 1,0-1,33 adequate moisture and above 1,34 excessive moisture. According to analysis the climate circumstances in Vojvodina are semi arid, and semi humid.

The period 1924-2003 was analysed in terms of sufficient amount of water, specified by the precipitation that crops need for regular growth consistent with Hardgrave's' model and index. Model is based on the analysis of 75% precipitation (P) and potential evapotranspiration (ETo). Based on the assessment, the area of Vojvodina has semi arid or arid climate during summer, which is not favourable for successful crop production, thus irrigation has high importance in the region.

Table 1 Percentage of the arid periods for all precipitation amounts in July and August, in Vojvodina (HMS Novi Sad), from 1924 to 2012

precipi-tation (mm)	July		August		drought severity
	Nr of years	%	Nr of years	%	
0-25	13	14.6	21	23.6	extremely drought
26-50	33	37.1	24	27.0	very drought
51-75	19	21.4	19	21.3	drought
75-100	10	11.2	11	12.4	moderately drought
	75	84.3	75	84.3	total drought
101-125	7	7.9	10	11.2	moderately rainy
>126	7	7.9	4	4.5	pluvial
total	89	100	89	100	

Table 2 Moisture Availability index (MAI) in Vojvodina

Parameter	Months				
	V	VI	VII	VIII	IX
P (mm)	46	68	50	40	32
ETP (mm)	77	118	139	130	61
MAI	0.60	0.58	0.36	0.31	0.52

Table 3 Potential evapotranspiration (ETo), and precipitation with probability of 75% and moisture availability index (MAI)

Months		VI	VII	VIII	VI-VIII
ETo		100	100-120	100-120	300-340
P (mm)	Subotica	52	44	44	140
	Novi Sad	70	44	39	165
	Sremska Mitrovica	70	44	32	174
MAI	Subotica	0.52	0.44-0.37	0.44-0.37	0.46-0.41
	Novi Sad	0.70	0.44-0.37	0.39-0.32	0.55-0.48
	Sremska Mitrovica	0.70	0.44-0.37	0.32-0.26	0.58-0.51

Analysis of the effects on agricultural production

Yield loss

According to the wheat and maize yield data of Hungarian Central Statistical Office, the most dominant field crops, in the period of 2000-2012 yields in 2000, 2002, 2003, 2007, 2009 and 2012 were below the average of the period, and maize showed the greater anomalies. The highest decrease of crop yield was seen due to the drought in 2012 (Fig. 5). In this year, the study area was highly affected, the maize yield was decreased by over 50% in Csongrád County, while in Bács-Kiskun County the crop yield dropped by 44% as compared to the average. The crop yield map for 2012 (Fig. 5) shows that the southern counties experienced the most substantial reduction. How-

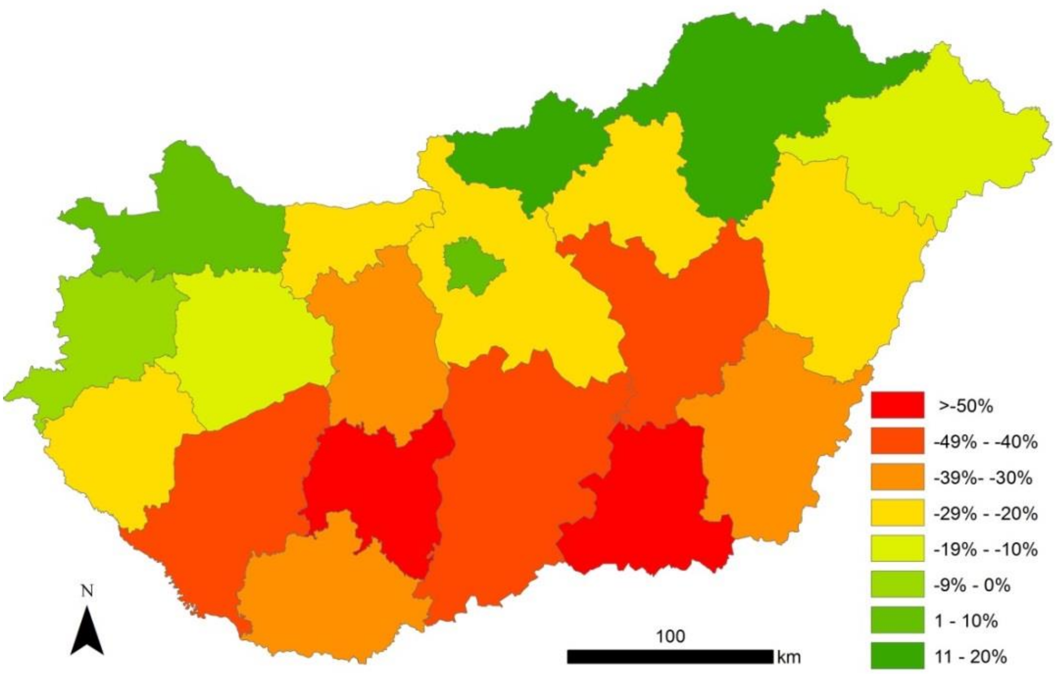

Fig. 5 Impact of drought in 2012 on the maize crop yield in the Hungarian counties (with reference to the mean value for 2000-2012)

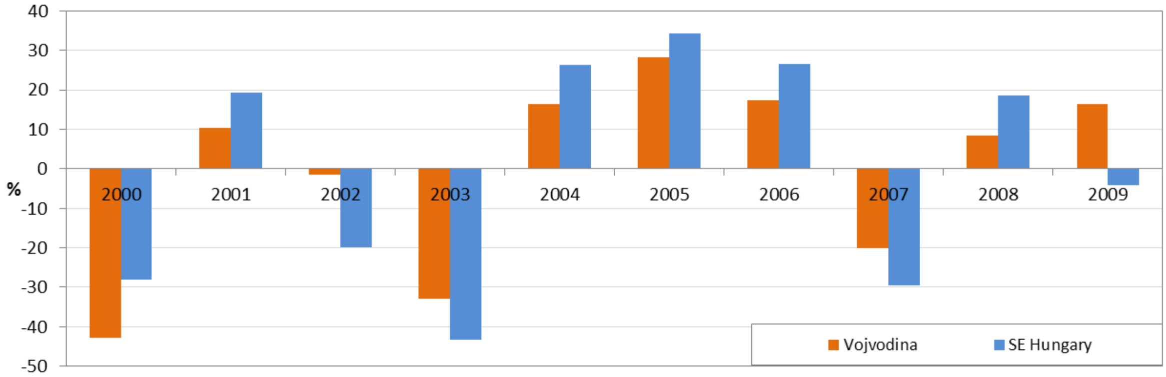

Fig. 6 Changes of maize yield in the study area (Vojvodina and south-eastern Hungary) compared to the multiyear average between 2000-2009 (Source: Research Institute of Agricultural Economics, Hungary and Banski et al. 2010)

ever, there were some Hungarian counties where, in the same year, farmers could harvest maize with yield exceeding the long term average values.

In Vojvodina in 2012 remarkable yield loss could be observed, similarly to the southern Hungarian counties. There was a 50% decrease in maize yield in 2012 compared to 2011, furthermore reduced yields for less sensitive cereals were also observed (wheat: 8%, sugarbeet: 30%, sunflower: 11% , soy: 35%, potato: 30%, beans: 40%, clover: 30%, tobacco: 25%) (Mészáros et al., 2013).

Figure 6 illustrates the changes in maize yield, as the most drought sensitive plant in the region between 2000 and 2009. The variation of yields are similar in both countries. The most remarkable decrease occurred in 2000, 2003 and 2007, while the best crop yields were recorded for the years 2004, 2005 and 2006. The highest yield loss in Vojvodina occurred in 2000, when the yield loss exedded the loss experienced in the southern Hungarian counties. In the other years strongly affected by drought (2003, 2007) the Hungarian part suffered bigger damage owing to the sandy soils typical for the Bács-Kiskun County area (due to the better water retention capacity of chernozem, meadow and alluvial soils in Csongrád County and Vojvodina). The greatest changes both in positive and negative directions were found in the Hungarian part.

Analysis of the connection between drought and crop yields

To reveal the connection between the drought severity and maize yields, yearly yield data were compared to the yearly PaDI values between 1961 and 2012. In the first analysed period (1961-1987) the yearly yield data and PaDI index value do not show connection. In this period serious droughts do not occurred, while the yield data show continuous development of the maize production.
In the second period the yearly maize yields have higher variability. This higher variability is caused by production changes after the political system change, because the transformation of plot structure was disadvantageous for unified irrigation, thus the rate of irrigation was greatly decreased and agro-technology is also changed. The decreased irrigation and changed agro-technology caused that the area became more sensitive to environmental hazards. Due to this increased sensitivity annual yields are in strong connection with drought sensitivity.

DISCUSSION AND CONCLUSION

Based on the temporal changes of the Pálfai Drought Indices (PaDI) it can be stated that drought severity considerably increased in the region. A significant increase of the average PaDI value was observed between

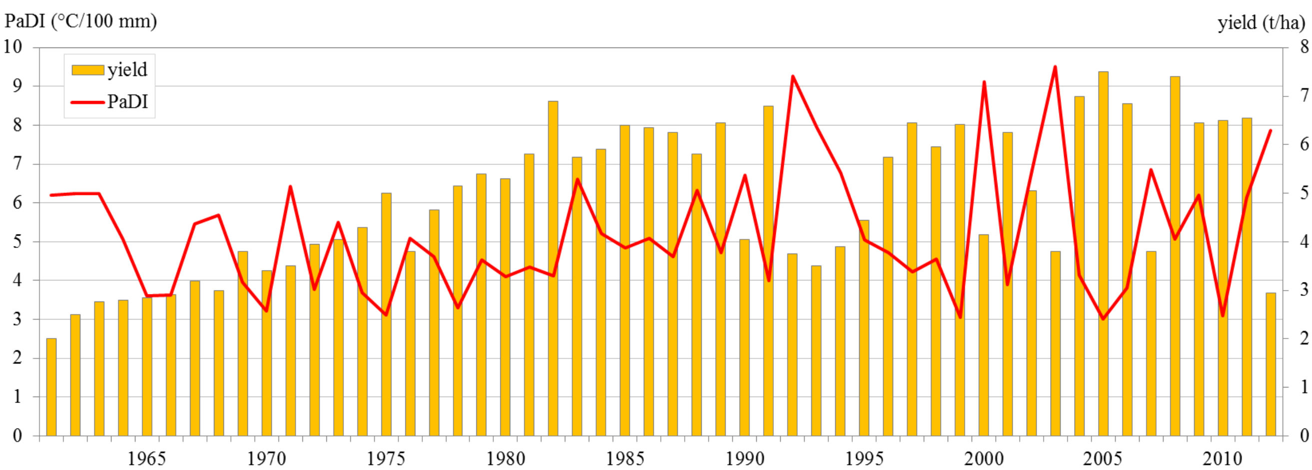

Fig. 7 The Pálfai Drought Index (PaDI) annual values and the annual average maize yield for 1961-2012

the two analysed period (1961-1987 and 1988-2012) in the case of nearly all stations. On some stations the rate of increase reached 30-40 %, which is mainly caused by the apparent temperature increase. Moreover, in the 1988-2012 period more serious droughts occurred than in the previous period, thus heavy droughts also evolved from the 1990s. Besides drought severity, frequency has also increased in the area. If the tendency continues in the future, the 30-year average value of PaDI is expected to be around the value of 8 until the end of the 21st century (Blanka et al. 2014).

Drought severity in consecutive years can be significantly different; therefore, the spatial pattern of drought severity is different from year to year. At several times no drought occurred in subsequent years on a certain location. On the other hand consecutive years with drought also occurred, especially from the 1990s. These significant changes in drought characteristics also had serious economic consequences.

The damages caused by drought could be indicated by the rate of agricultural yield loss, since this reflects the impact of this phenomenon most visibly. The damages caused by drought are also influenced by the tolerance of cultivated crops, soil properties and the presence of irrigation. The most sensitive plants are maize, legumes, vegetables and cereals. On the areas of Kecskemét, Kiskőrös, Tiszaalpár, Csongrád and Szeged, yield losses of some crops and the consequent economic losses were determined (Table 4) to revel the effects of drought on different types of crops with different sensitivity. The data clearly shows that water shortage has an impact on all cultivated crops. The financial value of lost yield is incredibly high where the added work is greater, thus the damages of the given sector are especially severe.

Yield loss data in Hungary demonstrated the intensifying damages as a result of the more frequent droughts from the 1990s (Fig 7). Because of the considerable spatial differences in drought severity in Hungary, the yields losses are also distributed unevenly. Based on statistical data the southern Hungarian counties experienced the most substantial reduction, as it was shown also in 2012. Based on the analysis of the 2000-2009 period the effect of droughts on crops in Vojvodina is similar to the southern Hungarian counties.

In Hungary the economic losses due to the drought in 1990 were estimated to reach 50 billion HUF, for 1992 the damages arising from the drought may have been 30 billion HUF (Rátky, 1992; Csizmadia, 1992). In 2003 the damage due to drought was estimated at 40 billion HUF (Láng et al., 2007). Yield loss as a result of drought in 2012 reached 400 billion HUF (Kerpely, Tripolszky, 2013). In Serbia the damages resulting from yield loss reached 600 million EUR in 2007 (Popov and Frank, 2013), and in 2012 damage at 2000 million EUR was reported (Mészáros et al., 2013).

In Hungary in the Danube-Tisza Interfluve, considering that the groundwater level had considerably decreased, the damages caused by yield loss due water shortage reached 11 billion HUF on average on the catchment of Tisza River (almost 5000 km^{2}). A special feature of the study area is the important tradition of vegetable and fruit cultivation that makes it sensitive to water deficit and drought. It is also important to mention that the mostly affected sectors are linked to smallholders, whose financial stability is much worse than that of large agricultural farms, where cereal production is typical. Consequently, damage can be expressed in numbers but has a lot more serious long-term impact on the farms.

The observed unfavourable changes in the region mean that water management and spatial planning faces conceptual challenges to prevent and mitigate the damages of drought, since the changing climatic and hydrological conditions generate new and increasing environmental and consequently social hazards in the future. Planning sustainable development requires the integration of economic, social, and environmental considerations as a key to maintaining basic living standards and protecting ecosystems. To reach these aims all the possibilities of agro-technological development, changing production structure, land use changes, development of irrigation technology, new concept in water management (water retention, reuse of water resources) and dynamic approach in nature conservation should be considered.

Table 4 Yield losses of some crops on the study area

	Kecskemét	Kiskőrös	Tiszaalpár	Csongrád	Szeged	
Area [ha]	123 768	97 592	49 752	18 701	106 197	
Gold crown value	11.4	8.5	19.7	17.7	9.1	
Crops	Yield loss (t/ha)					yield loss [million HUF/ha]
Cereals	0.3	0.3	0.3	0.3	0.3	20
Maize	0.9	0.9	0.8	0.8	1.0	70
Potato	2.0	2.0	2.0	2.0	2.0	240
Vegetables	2.5	2.5	2.0	2.0	2.2	360
Pasture	1.5	1.5	1.3	1.4	1.2	6
Fruit	3.3	3.4	3.5	-	3.8	5000

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