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Variability of Diameter Increment of Taxodium (*Taxodium distichum* (L.) Rich.) Under the Influence of Climatic Factors in the Area of Bačka Palanka in Serbia

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Abstract

Background and purpose: *Knowledge of the interaction between plant and climatic conditions is of great importance in establishment of new forests, especially in the introduction. Taxodium is an allochthonous species in Europe and this paper presents the data on the success of its introduction and adaptability to site conditions.*

Material and methods: *For the analysis of the climate characteristics in Bačka Palanka have been used the data of the Republic Hydrometeorological Service of Serbia for the period 1981-2010 regarding meteorological station Rimski Šančevi. Dendrometric analysis was performed on the dominant trees of Taxodium by taking an increment core at breast height using Pressler drill. On the increment cores was measured diameter increment per each year of the observed period. By the regression analysis was determined the correlation between the diameter increment and climate elements.*

Results and conclusion: *By research of influence of climate factors on the diameter increment of Taxodium trees can be concluded that with increasing of values of mean annual temperature and mean temperature during the growing season comes to a reduction in size of the diameter increment. The increase of the quantity of precipitation over a year, particularly during the growing season, leads to the increase of the diameter increment, and vice versa.*

Keywords: *Taxodium, climate, diameter increment, Bačka Palanka.*

INTRODUCTION

A number of studies on the global warming and potential changes of temperature and humidity, point to the very wide range of the effects and impacts, both on the forest ecosystems in general, and on the individual trees [1-3], the knowlegde on these interrelations and interactions plant-climate parameter, is of the growing importance. The afforestation and establishment of the conifer plantations in Serbia was very intensive during the last decades of the 20th century, and the conifer species were used not only for the afforestation of barren soil, but introduced in the forests of different tree species and degrees of degradation, on the sites of the different production characteristics. The influence of some climatic factors on the diameter and height increment of some tree species studied Fritts [4-7], La Marche [8], Wimmer and Grabner [9], Kilgore and Telewski [10], Zafirov [11], Tokar and Krekulova [12] and in Serbia Koprivica and Matović [13], Vukin and Isajev [14], and Radošević and Vilotić [15] and others.

The main task of this paper is to analyze climate elements and Thornthwaite's climate index, current diameter increment of Taxodium trees from seed stands near Bačka Palanka, the analysis of the influences of the pluviometric regime and climate index on the current diameter increment of Taxodium over the period 1981-2010.

MATERIAL AND METHOD

Only by using the multi-annual climate data, obtained by the meteorological measurements, can the current climate condition be validly estimated. For the purposes of analyzing climate characteristics and change in Bačka Palanka, were used the data of Republic Hydrometeorological Service of Serbia for the period 1981-2010, regarding the meteorological station Rimski Šančevi (situated at latitude 45 ° 20 'N and longitude 19 ° 51' E) i.e. the arithmetic means of the series of the available data, sorted by time and area [16]. Seed stand of Taxodium is 70 years old, located in Forest management unit "Palanačke ade- Čipski poloj " section 11, department a, which manages the Forest Enterprise (FE) Novi Sad, Forest Administration Bačka Palanka.

The pluviometric regime and air temperature were analyzed and the climate index was determined for each year of the observed period by using Thornthwaite's method [17, 18]. By using the complex calculation method, which is now presented by the special computer program, based on the average monthly air temperature and the average monthly quantities of precipitation, taking into account the latitude at which the observed site is located and the duration of daylight, the calorific index (*i*) and the annual calorific index (*I*) are determined first, and then, by applying the special logarithmic nomograms the uncorrected potential evapotranspiration (*PE*) is calculated, while, by the subsequent calculation process, the actual evapotranspiration (*SE*) and the water loss in the soil (*M*).

The final results refer to the humidity index (I_h), aridity index (I_a), and climate index (I_c), based on which, by using the classification prescribed by this method, the character of the climate for the observed area is determined. The climate index calculated in this way is the result of the basic climate factors (temperature and precipitation regime), coupled with the basic orographic elements (geographic coordinates of the observed site and duration of daylight).

Mean stand diameter in this artificially established stand is 51.7 cm. Dendrometric analysis was done on the dominant trees of Taxodium whose mean diameter is 67.7 cm. From twenty trees that are in the category of 20% of the thickest were taken the increment cores at breast height using Pressler drill. On the increment cores was measured diameter increment per each year of the observed period that was 30 years (1981-2010).

By the comparative analysis and statistical data procession (regression analysis), the correlation between the diameter increment and climate characteristics was determined (Computer Software Statgraph 6.0). It is given the graphic presentation of the climate indices, quantity of precipitation during a year and in the growing season (April-September), the mean annual temperature, mean temperature during the growing season (April-September) and the diameter increment of Taxodium in the observed period.

RESULTS AND DISCUSSION

Research facility

The researches were conducted in artificially established Taxodium stand aged 70, which is located near Bačka Palanka. The stand is located in the Forest management unit "Palanačke ade- čipski poloj", in Departmant 11a, at the altitude ranging from 76 to 80 meters above the sea level, on flat ground, with no clear exposure, on fluvisol soil type. It belongs to the coeno-ecological group of forest types of white willow and poplar (Salicion albae) on undeveloped, semigley soil.

Climate elements

Heat and humidity, along with other environmental factors, directly influence height, diameter and volume tree increment and stands in general, as well as the quality of wood volume. If the environmental conditions are the same, the quantity of wood volume, which can be produced by the forest vegetation, and the technical value of it, depend upon the variation of some basic climate factors [19].

Air temperature over the period 1981-2010

Air temperature is one of the most important climate parameters. Based on the processed data obtained by the Republic Hydrometeorological Service of the Republic of Serbia, the data on air temperature in the observed period (from 1981 to 2010) for the Rimski Šančevi Weather Station are presented in Table 1.

The average annual air temperature over the observed period is 11.4 °C, whereas the average air temperature during the growing season is 18.3 °C. In the hottest month of the year, July, the average air temperature is 21.9 °C, while in the coldest month of the year, January, it is 0.2 °C.

The average annual temperature in the observed period ranges from 10.1 °C (in 1981) to 13 °C (in 2000).

TABLE 1
The average monthly and annual air temperatures in Bačka Palanka area (°C), over the period 1981-2010

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Aver.
1981	-3.1	1.3	9.1	11.0	16.2	20.3	20.4	20.4	17.5	12.9	4.8	1.7	11.0
1982	-1.6	-0.7	5.4	8.0	17.9	20.8	21.1	20.7	20.1	13.1	5.6	4.2	11.2
1983	3.9	0.8	7.9	14.0	18.1	19.1	22.7	21.3	16.6	10.7	2.5	0.9	11.5
1984	1.1	0.5	5.0	10.6	16.1	18.3	19.3	20.0	18.0	13.2	6.2	0.2	10.7
1985	-5.5	-4.8	4.8	11.9	18.2	17.2	21.5	21.1	16.8	10.1	4.4	5.5	10.1
1986	1.6	-3.0	4.3	13.8	18.6	19.1	19.7	22.0	17.1	11.1	5.3	-0.2	10.8
1987	-3.9	1.2	-0.2	11.2	14.7	20.2	23.5	19.3	20.1	12.2	7.1	2.1	10.6
1988	3.5	3.8	5.5	10.3	17.1	19.8	23.7	22.4	17.2	11.1	0.3	2.3	11.4
1989	-0.3	4.7	9.4	13.9	15.5	17.8	21.9	21.1	16.5	11.8	4.8	2.5	11.6
1990	0.6	5.8	9.4	11.1	17.5	19.9	21.4	21.6	15.1	12.4	6.9	1.3	11.9
1991	1.0	-2.6	8.1	9.6	12.8	19.9	21.8	20.1	17.7	10.2	6.6	-1.7	10.3
1992	1.0	3.2	6.7	12.6	17.2	20.1	22.0	25.9	17.3	11.6	7.1	0.5	12.1
1993	-0.2	-1.9	4.3	11.2	19.1	19.9	21.5	22.0	16.6	13.1	2.3	3.3	10.9
1994	2.7	2.1	8.9	11.7	17.0	20.1	23.5	23.0	20.3	10.0	6.6	2.1	12.3
1995	-0.1	6.5	5.7	11.2	15.8	19.0	23.3	20.3	15.4	12.0	3.2	1.7	11.2
1996	-1.1	-2.4	2.2	11.6	18.1	20.6	20.0	20.8	13.1	11.6	8.5	0.5	10.3
1997	-1.4	3.3	5.5	7.5	17.7	20.7	20.1	20.2	16.0	8.5	6.5	3.0	10.6
1998	3.2	5.2	4.0	13.2	16.1	21.5	21.6	21.7	15.7	12.7	4.2	-3.8	11.3
1999	0.8	1.7	8.0	12.7	16.9	20.1	21.2	21.3	18.9	11.6	4.1	1.1	11.5
2000	-1.8	3.9	6.8	14.7	18.5	22.0	22.2	24.3	17.2	13.9	10.4	3.3	13.0
2001	3.0	4.1	10.2	10.9	17.8	18.0	21.8	22.4	15.1	14.1	3.6	-3.4	11.5
2002	0.2	6.7	8.6	11.1	19.1	22.0	23.5	21.5	16.4	12.1	9.5	0.5	12.6
2003	-1.9	-4.5	5.6	11.3	20.6	24.2	22.4	24.3	16.6	9.8	7.7	2.1	11.5
2004	-1.2	2.4	6.4	12.0	15.0	19.5	22.1	21.4	15.9	13.5	6.5	2.6	11.3
2005	0.1	-3.7	4.3	11.8	17.2	19.4	21.4	19.5	17.3	11.6	5.3	2.1	10.5
2006	-1.3	0.9	5.7	12.7	16.5	19.7	23.6	19.7	18.0	13.3	7.6	2.8	11.6
2007	6.1	5.8	8.9	13.4	18.5	22.1	23.3	22.7	14.6	10.6	3.9	0.0	12.5
2008	1.9	4.8	7.9	13.0	18.4	21.9	21.7	22.2	15.7	13.2	7.9	3.7	12.7
2009	-1.5	2.2	6.8	14.6	18.6	19.6	22.8	23.0	19.3	11.7	8.3	3.5	12.4
2010	-0.6	1.9	6.8	12.3	17.0	20.2	23.1	21.9	16.1	9.1	9.5	0.8	11.5
Aver.	0.2	1.6	6.4	11.8	17.3	20.1	21.9	21.6	16.9	11.8	5.9	1.5	11.4

Precipitation regime over the period 1981-2010

The data on the pluviometric regime are presented in the Table 2. The annual quantity of precipitation in Bačka palanka area over the observed period is 647.3 mm of rainfall, and it ranges from 287,8 mm (in 2000) to 938,4 mm (in 1999). During the growing season (April-September), the average quantity of precipitation is 379.0 mm, which accounts for 58.6% of the total annual precipitation. The month with the greatest number of rainy days is June, with 91.4 mm of rainfall, and the month with the smallest number of rainy days is February, with 31.4 mm of rainfall.

Hydrological balance determined by using Thornthwaite's method

The climate (hydrological) index according to Thornthwaite's method [17, 18], is one of the most comprehensive climate summary of some forest area. It is one of the indirect calculation methods for determination of hydrological balance and climate type. This method is, above all, frequently applied during the studies in forestry science, since it gives the greatest number of data on plant life [20, 21], such as the quantity of spare water in the soil (*R*, in mm) during the season when there is an excess of it *V* (mm), and during the season when there is a lack of it *M* (mm). Thornthwaite introduced the term potential evapotranspira-

TABLE 2
Monthly and annual sums of precipitation in Bačka palanka area (mm), over the period 1981-2010

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Aver.
1981	35.8	18.4	117.1	39.6	38.0	204.5	20.4	63.2	85.9	63.7	45.1	99.3	831.0
1982	26.3	16.3	66.8	67.7	22.7	69.7	59.0	58.9	9.5	48.6	25.8	62.7	534.0
1983	43.4	19.7	23.4	31.9	35.9	87.6	58.1	34.3	75.3	27.6	18.7	23.3	479.2
1984	66.5	35.3	13.1	38.5	107.7	47.4	98.1	42.4	30.4	56.2	49.4	16.7	601.7
1985	30.2	63.7	65.0	42.6	83.2	77.8	29.0	80.0	10.9	11.3	70.3	17.6	581.6
1986	52.0	47.5	37.5	56.9	50.8	50.4	77.1	40.0	4.3	42.0	6.7	16.1	481.3
1987	101.8	2.3	63.1	80.8	175.7	62.0	31.6	50.5	5.5	11.9	83.2	29.7	698.1
1988	36.2	42.7	94.2	56.8	25.9	64.6	20.1	17.1	55.3	12.1	20.0	25.2	470.2
1989	6.5	8.6	35.2	82.1	66.2	92.5	11.1	72.4	30.0	32.5	50.0	19.9	507.0
1990	6.3	35.4	33.3	34.2	17.9	69.8	28.4	14.7	52.0	52.8	38.8	67.1	450.7
1991	15.1	23.3	46.9	46.6	76.5	71.5	192.9	47.4	35.7	110.7	75.4	20.7	762.7
1992	7.0	22.2	3.3	30.9	39.0	106.1	21.6	0.2	32.1	142.6	84.9	43.9	533.8
1993	15.3	5.3	52.9	30.1	39.4	40.2	41.6	35.7	38.2	19.6	68.2	87.4	473.9
1994	41.4	33.6	31.8	53.5	71.1	101.4	31.8	44.7	42.6	58.5	25.4	33.5	569.3
1995	75.1	51.3	42.8	54.0	60.1	108.8	4.1	75.9	101.8	0.6	39.6	64.2	678.3
1996	46.3	34.5	29.8	25.2	90.0	79.1	83.9	112.8	119.2	33.1	94.5	65.9	814.3
1997	44.1	46.6	32.2	75.2	17.4	62.0	123.2	124.6	30.3	92.2	34.6	81.7	764.1
1998	67.5	0.9	22.6	39.8	64.1	103.7	123.8	82.3	76.9	79.0	66.5	27.9	755.0
1999	42.2	47.8	11.1	61.2	76.2	91.0	209.1	28.2	76.9	52.4	103.8	138.5	938.4
2000	15.7	8.1	31.7	24.6	40.4	31.5	29.7	6.4	15.5	6.9	23.4	53.9	287.8
2001	38.4	28.6	75.9	156.0	78.6	237.4	80.4	29.5	160.1	14.7	71.4	27.6	998.6
2002	7.5	28.4	10.1	30.4	84.7	27.5	35.0	53.8	47.5	91.7	23.7	41.6	481.9
2003	49.2	21.5	8.9	9.2	21.9	30.7	61.5	30.4	83.3	142.3	29.0	21.3	509.2
2004	53.4	43.3	17.8	118.6	87.9	97.4	65.1	39.3	50.1	86.1	142.9	33.8	835.7
2005	30.2	41.6	40.1	33.0	38.1	135.8	122.5	133.9	67.0	7.1	19.6	66.5	735.4
2006	30.5	43.5	72.5	66.0	70.1	104.3	30.9	124.9	23.8	17.6	17.1	39.8	641.0
2007	47.7	50.7	78.8	0.0	99.4	71.1	38.8	79.6	78.8	101.4	119.5	32.8	798.6
2008	25.4	7.6	42.8	21.9	46.2	115.9	41.6	14.0	93.6	18.4	57.5	43.1	528.0
2009	40.8	47.3	34.6	3.6	50.4	127.2	58.1	19.1	13.1	81.9	63.1	97.4	636.6
2010	76.0	65.7	38.7	63.7	113.7	171.8	99.0	168.5	67.7	66.6	46.5	64.0	1041.9
Aver.	39.1	31.4	42.5	49.2	63.0	91.4	64.3	57.5	53.8	52.7	53.8	48.8	647.3

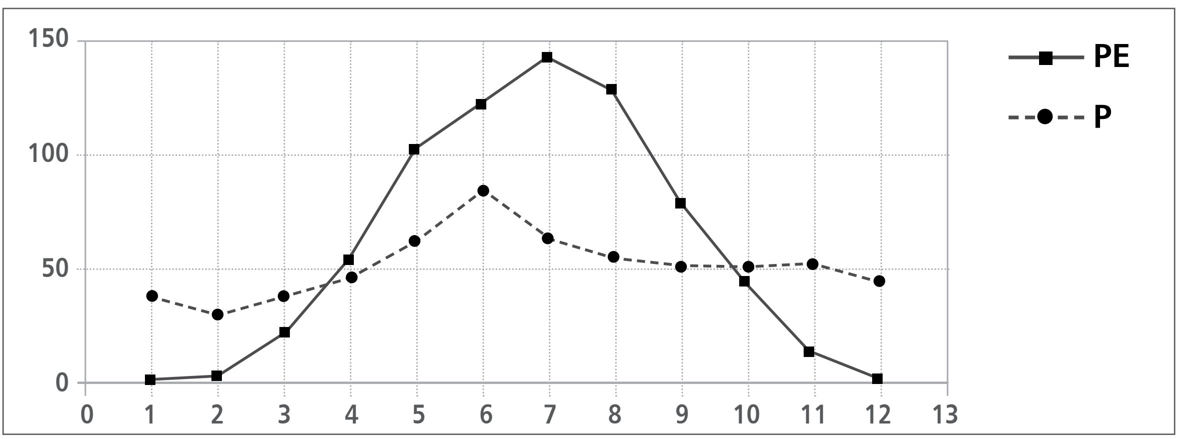
tion (*PE*). The uncorrected potential evapotranspiration (*PE*) refers to the quantity of water which would evaporate from the soil under the certain temperature conditions, when it reaches the optimal humidity, i.e. 100 mm of water up to 100 cm depth, throughout a whole year, i.e. 100 l•m^{-2}. It is equal to 603 mm over the observed period 1981-2010. Since evapotranspiration depends not only on the energy-temperature characteristics, but on the latitude of a certain area as well, the uncorrected potential evapotranspiration is corrected, and thereby the second parameter, the corrected potential evapotranspiration (*PE*) is determined. It is equal to 722 mm in Bačka Palanka area. The actual evapotranspiration (*AE*) is the real quantity of water which is released by transpiration from the plant or evaporates from the soil when it reaches the optimal humidity. It depends on both the energy-temperature conditions and the quantity of precipitation, and in this instance it is equal to 624 mm.

The humidity excess occurs not only at the beginning of the year, in January, February and March, but in December as well, and it is equal to 60 mm (as it does not occur during the growing season, it is of lesser importance to the plant). The lack of water, which is equal to 164 mm, occurs in July, August and September, and has an adverse effect on plant increment (Table 3, Graph 1).

TABLE 3
Hydrological balance according to Thornthwaite (1981-2010.)

	T (°C)	i	(PE)	PE	P	R	AE	M	V
I	0.2	0.01	0	0	38	100	0	0	22
II	1.6	0.18	4	3	31	100	3	0	28
III	6.4	1.45	22	23	39	100	23	0	16
IV	11.8	3.68	48	54	48	94	54	0	-6
V	17.3	6.53	78	103	62	53	103	0	0
VI	20.1	8.22	95	122	85	16	122	0	0
VII	21.9	9.38	106	143	64	0	81	63	0
VIII	21.6	9.17	104	130	56	0	56	74	0
IX	16.9	6.34	76	79	51	0	51	28	0
X	11.8	3.65	48	46	51	5	46	0	0
XI	5.9	1.29	20	16	52	42	16	0	0
XII	1.5	0.16	3	3	46	84	3	0	0
YEAR	11.4	50.06	603	722	624		558	164	60
V.P.	18.3			632	367		467	164	-6

Index humid.= 8.26381 Index aridn.= 22.7102 Climate index =-5.3623 DRY SUBHUMID CLIMATE – (C1)



GRAPH 1
Climate diagram according Thornthwaite for the weather station Rimski Šančevi, 1981-2010

TABLE 4
Humidity index (I_h), aridity index (I_a), climate index (I_c) and climate types determined by using Thornthwaite's method for the weather station Rimski Šančevi, 1981-2010.

Year	I_h	I_a	I_c	Climate type
1981	0	81.4171	-48.85	ARID - (E)
1982	11.2856	38.3661	-11.734	DRY SUBHUMID - (C1)
1983	-15.596	34.4147	-36.245	SEMI-ARID - (D)
1984	3.40306	19.1265	-8.0729	DRY SUBHUMID - (C1)
1985	11.5023	31.8364	-7.5996	DRY SUBHUMID - (C1)
1986	-1.3681	37.3262	-23.764	SEMI-ARID - (D)
1987	38.9877	39.7391	15.1443	MOIST SUBHUMID - (C2)
1988	7.90701	47.416	-20.543	SEMI-ARID - (D)
1989	-22.375	29.5854	-40.126	ARID - (E)
1990	-1.658	40.4085	-25.903	SEMI-ARID - (D)
1991	14.6262	3.76397	12.3678	MOIST SUBHUMID - (C2)
1992	9.0862	46.425	-18.769	DRY SUBHUMID - (C1)
1993	11.4399	48.3845	-17.591	DRY SUBHUMID - (C1)
1994	3.97241	28.7569	-13.282	DRY SUBHUMID - (C1)
1995	17.7248	21.7483	4.67585	MOIST SUBHUMID - (C2)
1996	21.9714	8.5633	16.8334	MOIST SUBHUMID - (C2)
1997	26.6338	15.9019	17.0927	MOIST SUBHUMID - (C2)
1998	5.67084	6.53068	1.75243	MOIST SUBHUMID - (C2)
1999	25.9862	1.74614	24.9385	MILD HUMID - (B1)
2000	-20.101	63.2524	-58.053	ARID - (E)
2001	46.2976	9.2512	40.7468	MODERATE HUMID - (B2)
2002	-7.3209	37.7059	-29.944	SEMI-ARID - (D)
2003	8.07373	48.8476	-21.235	SEMI-ARID - (D)
2004	31.9326	15.7893	22.459	MILD HUMID - (B1)
2005	5.36094	3.9467	2.99292	MOIST SUBHUMID - (C2)
2006	4.45894	21.3758	-8.3665	DRY SUBHUMID - (C1)
2007	23.7785	26.9406	7.6141	MOIST SUBHUMID - (C2)
2008	-5.1799	31.46	-24.056	SEMI-ARID - (D)
2009	13.887	38.8102	-9.3992	DRY SUBHUMID - (C1)
2010	43.234	0	43.234	MODERATE HUMID - (B2)
1981-2010	8.26381	22.7102	-5.3623	DRY SUBHUMID - (C1)

Climate index determined by using Thornthwaite's method

In the Table 4 are shown the values of the humidity index (I_h), aridity index (I_a) and climate index (I_c) in Bačka Palanka area regarding the observed period, as well as climate types determi-ned by using Thornthwaite's classification [17]. These data are important for the comparative analysis with the trends of the current diameter increment of Taxodium. The average general climate index in Bačka Palanka area over the period 1981-2010 is -5.3623, and the climate type is subhumid dry (C1). The average general index ranges from -58.053 (in 2000) to 43.234 (in 2010), i.e. the climate ranges from arid (E), to moderate humid (B2).

Diameter increment

Analysis of the average current diameter increment of Taxodium trees per years over the observed period

TABLE 5
Correlation matrix

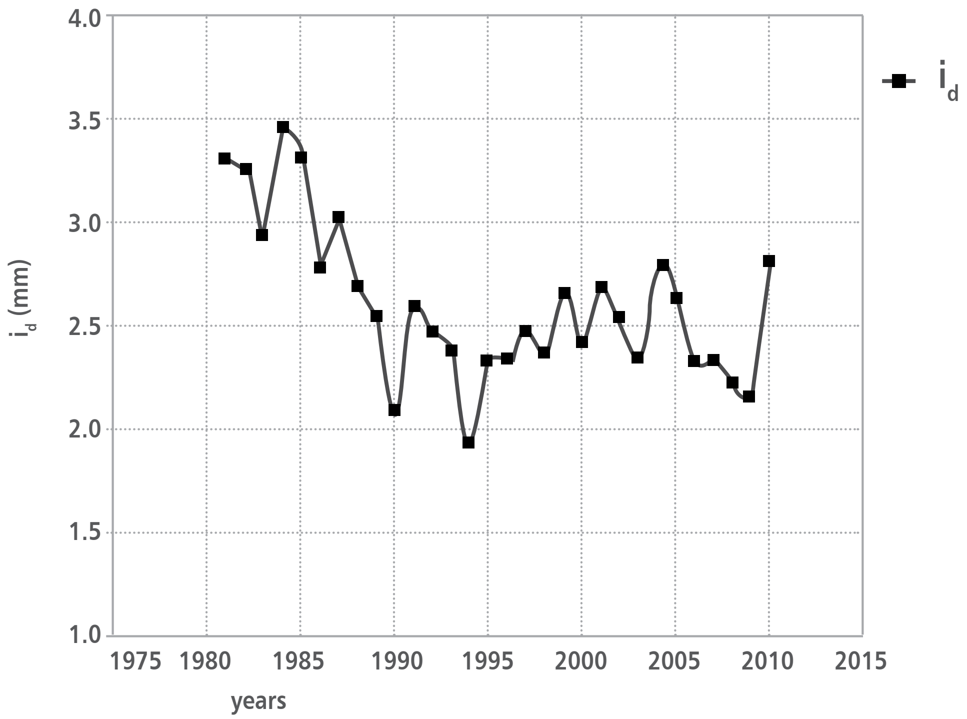
	i_d	p	t	i_c	p_v	t_v
i_d		0.1485	-0.5179	0.0243	0.1668	-0.4191
		0.4335	0.0034	0.8987	0.3784	0.0211
p	0.1485		-0.3206	0.8323	0.9240	-0.4061
	0.4335		0.0841	0.0000	0.0000	0.0260
t	-0.5179	-0.3206		-0.3751	-0.3566	0.7518
	0.0034	0.0841		0.0411	0.0531	0.0000
i_k	0.0243	0.8323	-0.3751		0.7820	-0.3807
	0.8987	0.0000	0.0411		0.0000	0.0379
p_v	0.1668	0.9240	-0.3566	0.7820		-0.4822
	0.3784	0.0000	0.0531	0.0000		0.0070
t_v	-0.4191	-0.4061	0.7518	-0.3807	-0.4822	
	0.0211	0.0260	0.0000	0.0379	0.0070	

shows the expected growth, but also significant oscillations in years when climatic conditions were the most important site factor which directly influenced the variations of the elements of growth.

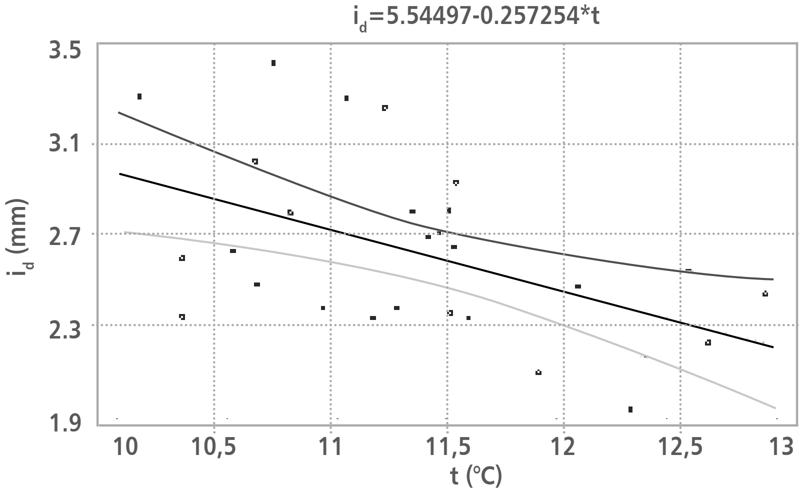
The size of average current diameter increment of Taxodium trees ranges from 1.92 mm in 1994 to 3.46 mm in 1984, and annual average value is 2.61 mm (Graph 2).

The impact of the climate elements on the diameter increment

The values of correlation coefficients, presented in the correlation matrix (Table 5), show that there is a correlation between trends of current diameter increment (i_d) and climatic parameters (annual amount of precipitation - *p*, mean annual temperature - *t*, amount of precipitation in the growing season - p_v, mean temperature during the growing season - t_v and



GRAPH 2
Current diameter increment (i_d) of Taxodium trees, 1981-2010.



GRAPH 3
The impact of the mean annual temperature (t) on the diameter increment (i_d)

climate index - i_c). On this basis it can be concluded that the climate is an important site factor that directly influenced the course and the variation of current diameter increment.

The correlation between the amount of annual precipitation and diameter increment is positive, but this relationship is not in the range of significance (Table 5). With increasing of amount of precipitation, the value of the current diameter increment is also increased.

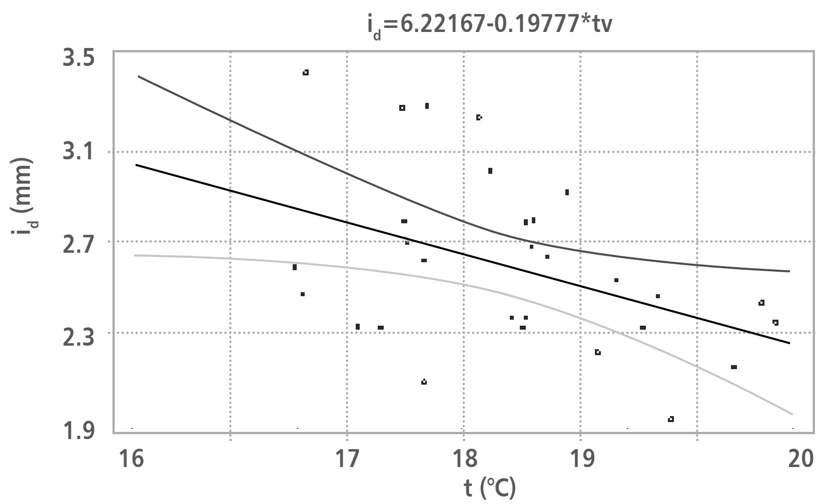
Mean annual temperatures have a greater impact on the value of the current diameter increment, the correlation coefficient is negative, and the relationship is in the range of significance (Table 5, Graph 3). With increasing of mean annual temperatures, the size of the current diameter increment decreases.

The correlation coefficient between the climate index and diameter increment is positive, but this relationship is not in the range of significance (Table 5).

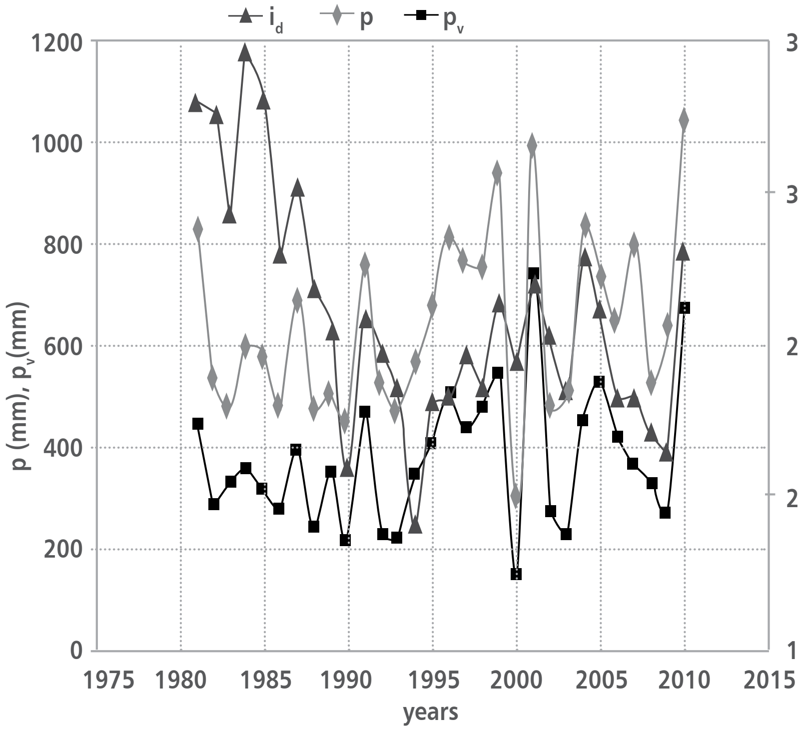
Value of the correlation coefficient between the amount of precipitation in the growing season and diameter increment is positive, but it is not in the range of significance (Table 5). With increasing of amount of precipitation, the size of the current diameter increment increases.

The influence of high temperatures during the growing season on diameter increment is more clearly defined. The correlation coefficient is negative, and it is in the range of significance (Table 5, Graph 4). With decreasing of temperature values, the value of diameter increment increases.

In Graph 5, which shows the fluctuations of diameter increment, precipitation (annual and in growing season), it is evident that the line of the current diameter increment follows the fluctuation of the annual



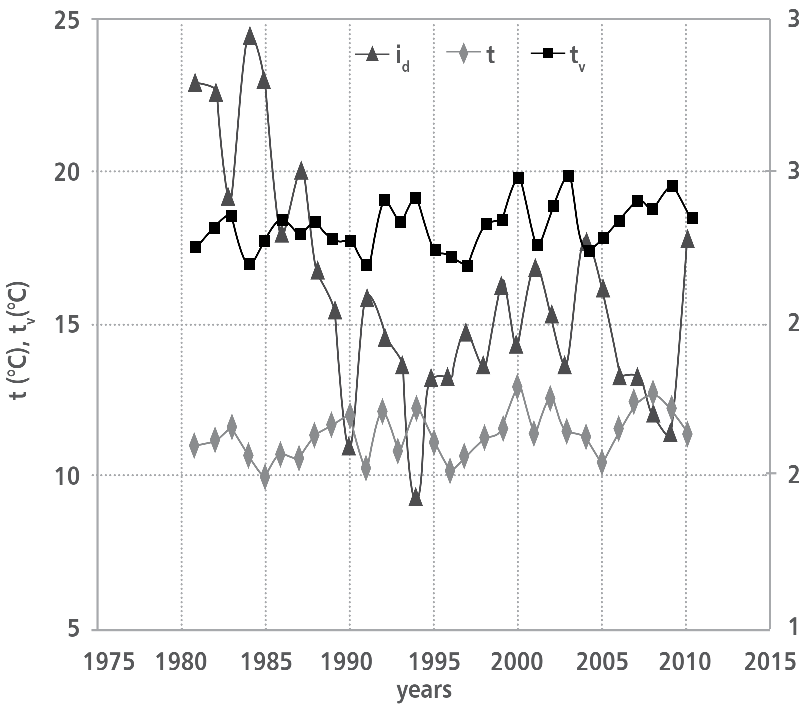
GRAPH 4
The impact of the mean temperature during the growing season (t_v) on the diameter increment (i_d)



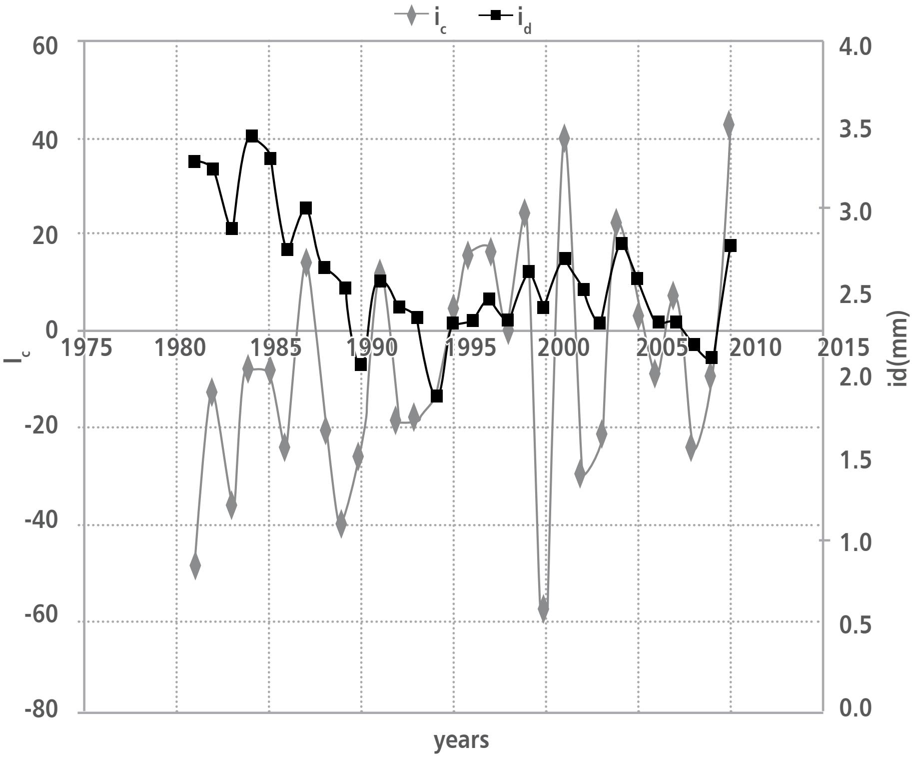
GRAPH 5
The correlation of the trend of the current diameter increment (i_d), annual precipitation (p) and precipitation in the growing season (t_v)

sum of precipitation and precipitation in the vegetation period per years of the observed period. With increasing of amounts of precipitation during the year, especially in the growing season, the diameter increment increases, and vice versa.

In Graph 6, which shows the fluctuations of diameter increment, mean annual temperatures and mean temperatures in the growing season, it is evident that with the increasing of the temperature the size of the diameter increment decreases, and vice versa.



GRAPH 6
The correlation of the trend of the current diameter increment (i_d), mean annual temperatures (t) and mean temperatures in the growing season (t_v)



GRAPH 7
The correlation of the trend of the current diameter increment (i_d) and climate index (i_c)

In Graph 7, which shows the fluctuations of diameter increment and climate index it is evident that their correlation exists.

The following authors had similar conclusions in their researches with other species: with Austrian pine (*Pinus nigra* Arn.) Tokar and Krekulova [12] in Slovak Republic, then Koprivica and Matović [13] in Ibarska Gorge in Serbia; Vukin and Isajev [14] on Mount Jelova gora in Serbia; with Scots pine (*Pinus sylvestris* L.) Zafirov [11] in area of Vitosha Mountain, Bulgaria, then Kilgore and Telewski [10] in Northern Michigans, North America; with spruce (*Picea abies* L.) Wimmer and Grabner [9] in Eastern Ore mountains in Germany, Kilgore and Telewski [10] in Northern Michigans, North America.

CONCLUSIONS

Based on the research of the impact of the climate elements on the current diameter increment of the Taxodium trees and the obtained results, the following conclusions are made:

- The climate is the important site factor that directly influenced the fluctuation and the variation of current diameter increment.
- The values of the correlation coefficients show that there is a correlation between the trends of the current diameter increment and annual sums of precipitation, mean annual temperatures, sums of precipitation in the growing season, mean temperatures in the growing season and climate index.

The increase of the mean annual temperatures and mean temperatures during the growing season leads to the decrease of the diameter increment. The increase of the quantity of precipitation over a year, particularly during the growing season, leads to the increase of the diameter increment, and vice versa.

It implies that Taxodium as the species that grows on moist stands is able to react to the increased humidity as one of the most important site factors, upon which the growth of the basic quantitive tree parameters directly depends.

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