Global Warming and Grapevine Cultivation Opportunities in Poland

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Abstract

The paper aims at comparing totals of effective temperatures ≥ 10ºC (April-October) over the periods 1961-1990 and 1991-2000 over Poland, hence to target new areas where — as such indices may indicate — opportunities of cultivating grapevine occur. The data from 36 weather stations, quite regularly distributed over Poland, were compared. They showed that for South-western Poland, apart from the mountainous areas, in the period 1991-2000 the values for totals effective temperatures ≥ 10ºC were higher than 3 000 degree-days, whereas in the middle Odra valley such values reached even 3 150 degree-days. The increment, when set against the data from 1961-1990, could be estimated to over 166 degree-days in South-western Poland and to 250 degree-days in the vicinity of Wrocław.

Key-words: global warming, grapevine cultivation, Poland.

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Political and economic changes that took place in Poland in 1989 brought also a different perspective towards rural areas, which stopped being perceived solely as a source of food provisions, raw plant and animal resources for industry, or poorly qualified labour force. In the context of a progressively diminishing role of agriculture in the national economy, a new concept of multifunctional development of rural areas has been developed. It shall result in the emergence of new, not necessarily directly agriculture related production, trade, and service functions within the rural areas. Such functions as recreation, sport and tourism, commonly called agrotourism, are good examples (Sznajder and Przezbiórska, 2006). To many farmers, agrotourism can provide a rare opportunity to sell limited products and services, which despite their scarcity are still plentiful enough to provide reasonable means of living to their producers, or at least enhance their means range. One such opportunity is grapevine related activities, its cultivation and picking, wine production, cellars visiting and home-made wine tasting, as it happens in Poland's neighbouring countries to the south. Such emerging agrotourism activities in rural areas are fuelled not only by political and economic transformations, but also favoured by the climate change and warming, which opens wider scale cultivation opportunities.

Between 1951 and 2000 the average annual air temperature in Poland increased by 0.9°C. The biggest increase, though insignificant statistically, was observed for the months of January and February (of 2.1 and 3.2°C, respectively), while a statistically significant increase of 2.8°C was found for March. Long term temperature observations conducted in Poland in the second half of the twentieth century, gave ground for distinguishing the last two decades, when climate warming was most significantly pronounced. Over the studied period 1951-2000, the highest annual temperatures of 9.5°C was recorded in 2000 (Kożuchowski and Żmudzka, 2001). It was a year of intense drought in northern Poland, with precipitation of few percent of the normal value (Ziernicka and Zawora, 2002). According to the data gathered between 1991 and 2000, the areas

of warmest climate in Poland, hence most favourable for grapevine cultivation comprised middle Odra valley and Tarnów vicinity. In the middle Odra valley, in Legnica, the highest average annual air temperature reached 9.2°C, whereas in Słubice, Opole and Wrocław it was equal to 9.1°C. The surroundings of Tarnów represent the warmest in Poland between April-August (15.6°C). Within the vegetation season (April-October) the air temperatures in Legnica and Tarnów are identical, and tend to reach 14.3°C (Zawora, 2004; Zawora, 2005).

Another essential criterion used to determine grapevine cultivation opportunities is the total of effective temperatures for a vegetation season, i.e. from April to October, ≥ 10°C. The present study aims at comparing totals for such temperatures in the span of years 1961-1990, and 1991-2000 all over Poland, which in turn can lead to identifying new areas, where, according to this specific index, grapevine cultivation opportunities occur.

I. Material and method

The focus data for the purposes of this study covered average monthly air temperatures over a standard period from 1961 to 1990 (Kossowska-Cezak *et al.*, 2000), as well as the last decade of the twentieth century (Monthly Agrometeorological Reports, IMGW Archives) collected at 36 weather stations, regularly distributed all over the lowlands of Poland. Namely, they were weather stations in Białystok, Chojnice, Częstochowa, Gorzów Wielkopolski, Kalisz, Kętrzyn, Kielce, Koszalin, Kraków, Legnica, Lębork, Lublin, Łódź, Nowy Sącz, Olsztyn, Opole, Ostrołęka, Płock, Poznań, Przemyśl, Racibórz, Rzeszów, Sandomierz, Siedlce, Słubice, Suwałki, Szczecin, Szczecinek, Świnoujście, Tarnów, Toruń, Warszawa, Wrocław, Zamość, Zgorzelec, and last but not least Zielona Góra. The lack of weather stations in the hilly and mountainous areas of the country shall be mentioned here.

Having studied the course for average monthly readings, it was possible to determine the dates when the threshold of 10°C for average daily air temperature has been crossed. For the period with temperatures ≥ 10°C, totals of daily air temperatures have been calculated, which are considered to be the effective temperatures totals. The spatial distribution of daily air temperatures totals has been plotted for both studied periods (see figures 1 and 2). A map of spatial distribution for occurring differences in effective temperature over the periods under comparison. The period 1991-2000 served as a minuend, while 1961-1990 period was set as an subtrahend. It allowed us to identify areas, where the most significant increase in effective temperature totals were recorded (see figure 3). Finally, the observed increases in the air temperature for particular months of both vegetation and winter seasons have been examined.

II. Results

As shown on the figure presenting distribution of effective temperatures totals ≥ 10°C over the 1961-1990 period (figure 1), only two stations proved to have effective temperatures totals slihtly higher than 3 000ºC, namely Opole weather station situated in the southern part of the Odra Valley, and Tarnów station situated in the western part of the Sandomierska Valley. The warmest areas with effective temperature totals higher than 2 900ºC turned out to be located in the South-western part of Poland, i.e. Silesian Lowlands (Nizina Śląska) and a western part of Great Poland Lowlands (Nizina Wielkopolska). A slightly cooler area, lying within the isolines 2 800-2 900ºC cover Wielkopolska Lakeland, Mazowiecka Lowland, Krakowsko-Częstochowska

Upland and Sandomierska Valley. For the remaining areas i.e. Lake Districts, Podlaska Lowland, Świętokrzyskie Mountains and Lubelska Upland, effective temperatures totals fall below 2 800ºC. The coolest areas with values not reaching 2 600ºC belong to highest parts of Pomerania Lakeland and North-eastern fringes of Poland (figure 1).

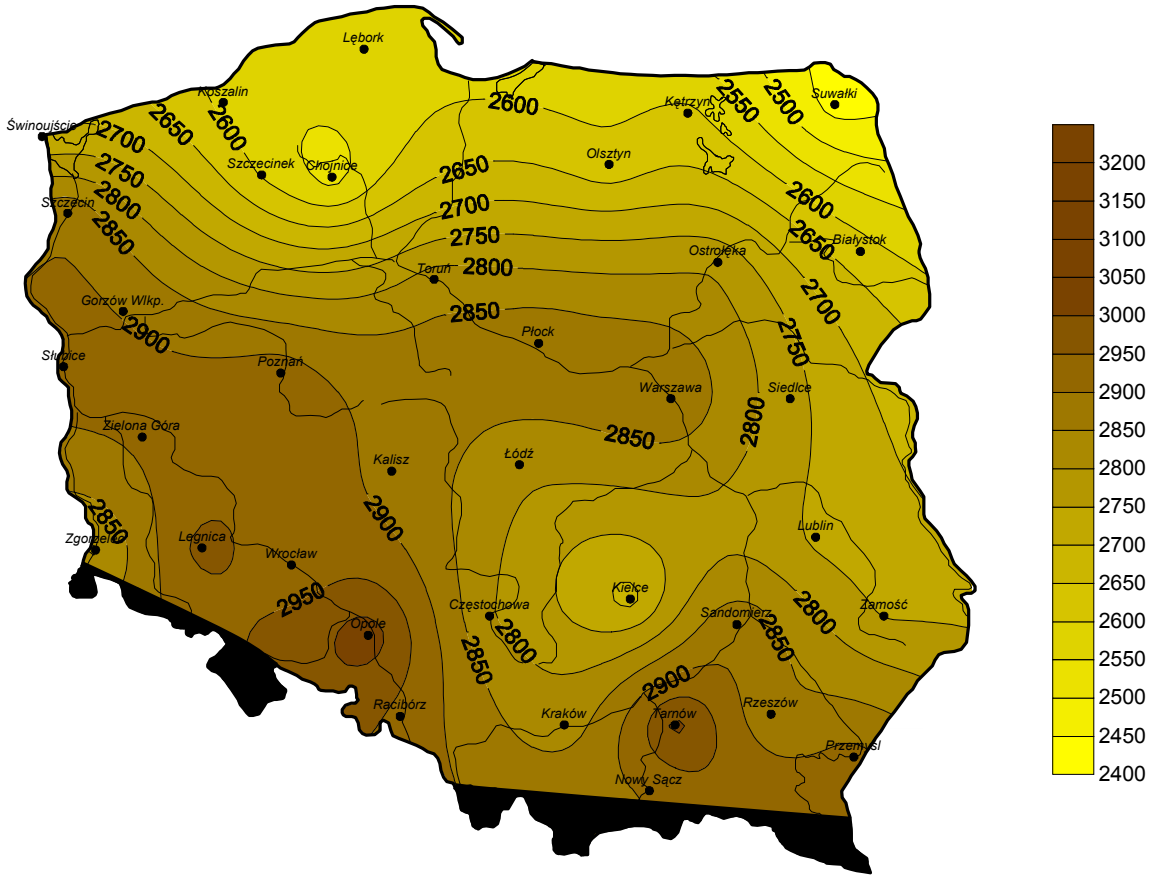

Figure 1. Mean annual totals of effective temperatures ≥ 10°C over Poland (1961-1990)

On the map dated 1991-2000 (figure 2) the warmest regions, with effective temperatures totals above 3 150ºC, are located in the middle Odra Valley, close to Legnica, Wrocław and Opole towns. The of 3 000ºC isoline, which over 1961-1990 used to embrace only the close neighbourhood of Opole and Tarnów, has drifted in the south-west direction, and now encompasses a wide part of south-western and southern Poland (excluding the mountainous areas), namely Silesia Lowland, Wielkopolska Lowland, Wielkopolskie Lakeland, the western part of the Silesian and Krakowsko-Częstochowska Uplands, as well as the Carpathian Foothills excluding their eastern most parts. Slightly cooler regions with effective temperature totals ranging between 2 900 and 3 000ºC include the south-western part of Pomerania Lakeland, Mazowiecka Lowland, eastern parts of Krakowsko-Częstochowska Upland and Sandomierska Valley. The coolest regions with effective temperature totals lower than 2 800ºC cover only the eastern part of Pomerania Lakeland and Masurian Lakeland (figure 2).

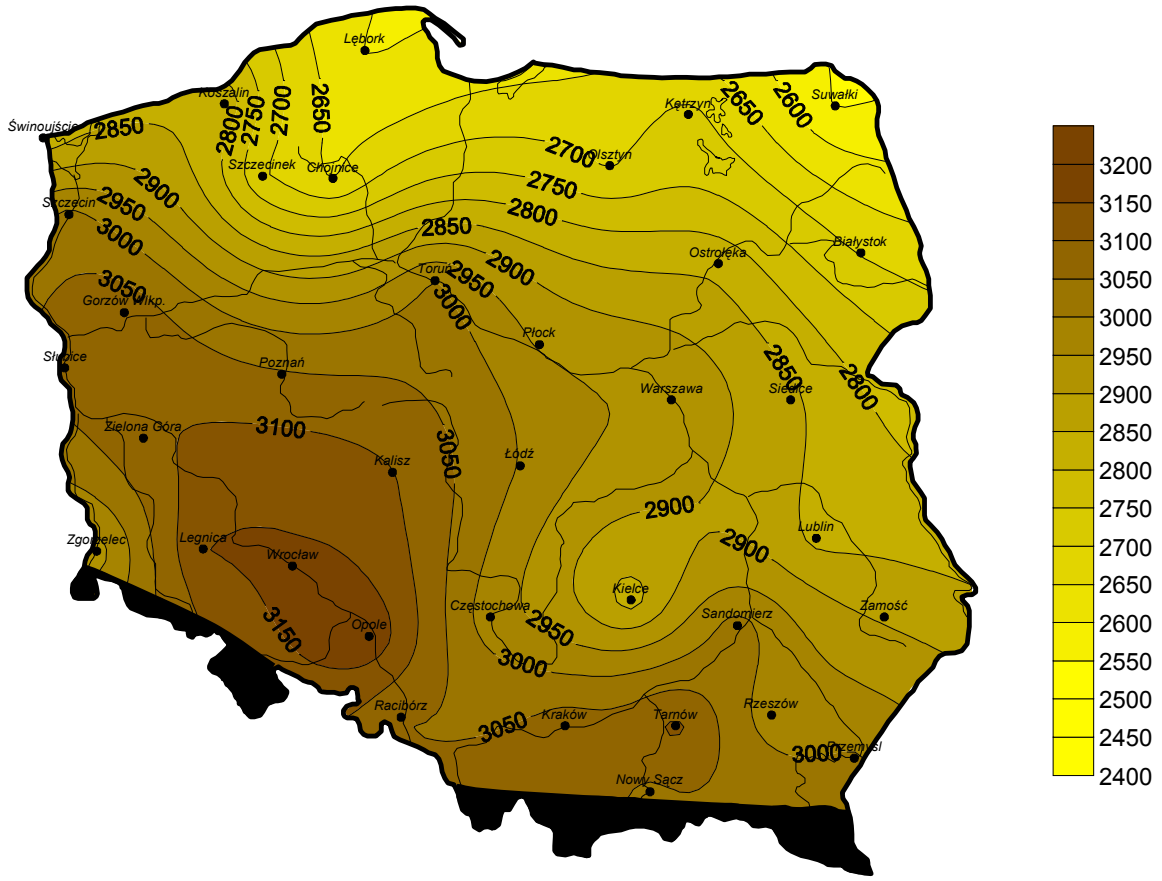

Figure 2. Mean annual totals of effective temperatures ≥ 10°C over Poland (1991-2000)

The average increase in the number of degree-days between comparable periods for the entire area of Poland has reached 132ºC. The highest increase in effective temperatures ≥ 10°C, over 150°C, was recorded in the western part of Poland, with maximum in Krakow 250°C, Wrocław and Koszalin 245°C. In eastern Poland the differences were not exceeding 100°C (figure 3).

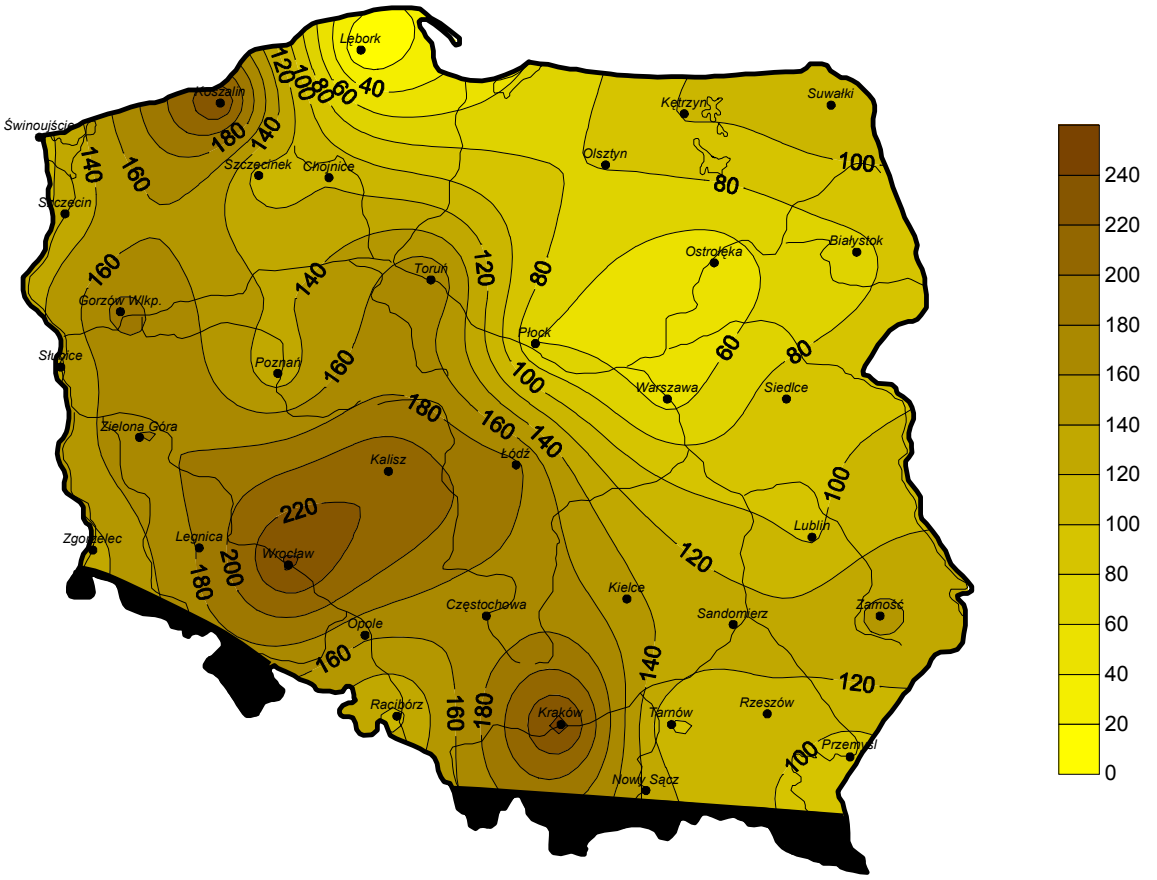

Figure 3. Differences in totals of effective temperatures ≥ 10°C over Poland between the periods of 1991-2000 and 1961-1990

It shall be noted that studies on the increase in air temperature for specific months of the vegetation season between the concerned periods found that the greatest temperature increase over the years 1991-2000 occurred in April, May, July, August and September as far as Western Poland is concerned. The steepest temperature growth by a value of 1.1°C was observed in August in the entire area of Poland, whereas in Kalisz, Kraków and Wrocław the value reached 1.5°C. It is also worth noting that the warming over the last decade of the twentieth century, when compared to three decades of 1961-1990, was most pronounced for the winter season. The temperature rise in January and February for the entire area of Poland has reached 1.9 and 1.5°C, respectively. North-eastern Poland, the area considered as the coolest in the winter season, was found to be the region of the highest increase in temperature.

III. Summary and conclusions

The conducted research has shown that a significant increase in air temperature, in the last part of the twentieth century, has contributed to shaping favourable climate conditions for grapevine cultivation in Poland. Though in the years 1961-1990 only areas close to Opole and

Tarnów lied within the effective temperature total 3 000°C isoline, in the last decade of the ties twentieth century the area within the same isoline comprised 30% of Poland, spreading over the south-western regions, the Karpackie Foothills and Sandomierska Valley. If this value of effective temperature totals above 10°C is set as the lower cultivation margin for not too demanding grapevine varieties, the area delineated may be considered as grapevine opportunity land for cultivating such varieties, whereas only the cultivation of early grapevine varieties seemed reasonable in the preceding period. According to the study by Cherszkowicz (1979), based on data from 1931-1960 (and most likely out-dated), on the agro-climate taxonomy of regions with regards to fundamental crops — including grapevine — within the used-to-be socialistic block European countries only small regions in Wrocław and Tarnów vicinity lied within the highest effective temperature totals isoline of 2 600°C. According to Cherszkowicz the cultivation of early grapevine varieties was believed to be possible in these areas.

Grapevine cultivation has recently regained popularity and has been focusing a momentous interest in Poland. In 2003 a Grapevine and Wine Institute was established. In 2005 Poland was graded A, as the most northern grapevine cultivation zone, a zone to which Belgium, Holland, Denmark, Luxemburg, UK, Sweden and the northern part of Germany belong. Trading wine produced from home-made grapevine is allowed under UE legislation. Since the production is low, no bans or restrictions on setting up new vineyards in Poland shall be expected. Nevertheless, despite distinct climate warming symptoms in Poland, no new regions for grapevine cultivations have been defined. The effective temperature total ≥ 10°C map for Poland, published in a revived Polish winemaking handbook, defines six division zones — from coolest below 2 200°C to warmest above 2 600°C; (Myśliwiec, 2006) — but does not show the 2 700°C isoline. Presumably thus it is based on the data recorded prior to observing distinct climate warming symptoms. Most of the new vineyards are being established in the regions where grapevine cultivation used to take place, such as Lower Silesia, Great Poland (Wielkopolska), or Krakowsko-Częstochowska Upland. However, naming the regions whose names would be easily associated with the origin of the wine produced there in, has remained a void effort so far. Obviously, the observed climate warming has provided a new favourable factor for grapevine cultivation and Polish wine making. Such local production could be an additional income source for agro tourism oriented households in regions where soil and climate conditions make the grapevine cultivation feasible.

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