CHARACTERISTICS OF AIR TEMPERATURE IN A Beech ECOSYSTEM

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Abstract

In this paper we summarise the characteristics of air temperature in submountain beech forests. The research was running in 1998-2003 in conditions of the Beech Ecological Experimental Site Kremnické vrchy Mts. We have found the mean annual temperature of 8.6 °C, that is by cca 2°C over the long-term mean (6.8°C). The coldest month was December (-6.2°C), resp. January (-4.4 °C), the warmest August (21.8 °C), resp. July (21.0 °C). On all the partial plots, periods without frosts lasted from April to September, i.e. approximately 50%.

Most days with temperature above 10 °C are in May-August (mean 163 days per year). There has not been found any evident influence of cutting intervention on spatial variability of air temperature.

Key words: air temperature, submountain beech forest, ecological site

INTRODUCTION

According to Pallmann et al. (1940) temperature is the leading factor influencing the events in both non-living and living nature. It controls the rate of chemical and physiological processes running in similar conditions. In case of mostly irreversible biological or inorganic reactions, it substantially influences quantitative extent of the reaction. Temperature is one of the most important growth stimulators. Intensity of assimilation and respiration in green plants is dependent on temperature. The microbial activity is controlled by specified, systematically directed temperature laws. Regional patterns of soil types are closely connected with the temperature regimen on the soil surface. All these facts are high important and require attention with the aim to recognise and understand in more details this undoubtedly immense meteorological phenomenon. This has been supported with a number of authors examining the issue under different conditions and in different regions. In Slovakia it was Petrik (1978, 1988), Střelec (1990, 1991), Lapin (1985). From abroad we mention here Pallmann (1940), Mitscherlich (1971), Krečmer (1980), Volpers (1989), Slavov, Raev (2001), etc.
METHODS

We measured air temperature at 20 and 200 cm above the soil surface on five partially plots in the Beech Ecological Experimental Site (BEEES) Krmenčíké vrchy Mts. (Central Slovakia). The locality belongs to the moderately warm climatic region, moderately moist, moderately warm mountain climatic district with mean annual temperature (1951-1980) of 6.8°C. The studied stand is situated on a regular, WSW oriented slope with an inclination of 12.5°-18°, at altitude 450-510 m. More details about the site can be found in Janík (1994), Pichler (1996), Barna (2004), Kellerová (2006).

The air temperature was measured continually, using thermo-hydrographs THG 867 in standard meteorological boxes placed on each partial plot. The research ran in 1998-2003.

The statistical evaluation was carried out using the software package Statistica – methods of regression analysis and simple pair testing.

RESULTS

Temperature characteristics of the studied area over the period 1998-2003 are summarised in Table 1. For comparison with other authors, we give the temperature values measured at 200 cm above the ground on the open plot and on the control plot without intervention. All the studied years appear above-normal from the long-term perspective (6.8°C). Similar results were obtained by Střelec (1991,1992) who found a mean annual temperature of 8.4°C on the same plots in 1991. This phenomenon can be explained in two ways. In the first case we can assign the most influence to the global warming. The second hypothesis is beginning of a warm episode in the frame of some longer period. Which one is true, it will show trends in temperature course in the next years.

The lowest temperature occurs in December or January (-6.4/-4.5°C), the warmest month is August or July (21.8/21.0°C). The annual temperature range is quite considerable.

Absolute maximum and minimum values represent the limits of air temperature range (Table 3, 4). Absolute minimum was recorded in January 2003 (21.0°C), absolute maximum in August 2000 (35.2°C).

Comparing the monthly values of absolute maximum and minimum we can see that the strongest temperature fluctuation was associated with April (28.4°C), the lowest was found in July (21.0°C). Petrović (1964) found a fluctuation range of March temperatures being 48°C in the valley of Slač, not far from our research plots. Similar results were obtained by Petrík (1978) focussing his research onto the south extremities of the Kremnické vrchy Mts.

The number of summer days is lower than 50, consequently, the studied area belongs to the moderate climatic region of Slovakia.

Frosts mostly occur from October to February, the period March-September is favourable for vegetation development. We have not recorded any frost occurrence from May to August.

From the viewpoint of ecology is very important the onset of the period with an average 10-degrees temperature (Table 2). In the recent years, the number of these days did not decrease below 170 (46 %). Petrík (1978) reports 150 days with the temperature above 10°C for close village of Trnie. More details about this characteristic: onset, duration dependence on altitude, are studied by Slavov; Raev (2001).

Střelec (1993) who compared between the values of air temperature in period of dormancy and in vegetation period on the same plots at the BEEES did not find significant differences between the plots I with intensive cutting (stocking 0.3), plot S with moderate cutting (stocking 0.5) and plot M-medium intensity (stocking 0.7) in the values measured at 200 cm above the ground. In case of the values measured at 20 cm above the ground, there was not found any significant difference between the partial plots, except the open one. The cause can be assigned to the foliage of the parent stand and its influence on the ground layer.

Chrost (1960) supposed that the application of cutting intervention of varying intensity should induce more pronounced changes throughout the whole stand profile.
However, he could not have confirmed this hypothesis, not even by several times repeated short-term measurements. The difference between the measured values did not exceed 0.4°C, and the author had to conclude that it is not possible to judge about the dependence of temperature on the canopy density. Rather small differences have also been reported by Pasák (1969).

Intribus (1966) examining the differences in mean daily temperatures between plots thinned from above, thinned from below and control found values of 0.2–0.5°C.

**CONCLUSIONS**

Our 6-year (1998–2003) observations of temperature in conditions of submountain beech forests at the BEES can be summarised as follows: mean annual temperature of years 1998–2003 at the site is 8.8°C on the H200 and 8.4°C on the K200, it is above the long-term normal of 6.8°C. The coldest month is in general January or December (-4.4°C - 6.2°C), the warmest is August (21.8°C). The widest temperature range (difference between the absolute maximum and minimum) was recorded in April (27°C). The number of days with temperature above 10°C ranges between 170-178. The average number of frost days is 106. The lowest mean annual temperature values were recorded on plot H (-20.0°C in year 2003). Similar situation was at: 200 cm over the soil surface, but in this case was the coldest plot the control without cutting intervention (-20°C).

Finally, it is necessary to emphasise that the microclimate characteristics alone, without putting in connection to physiological processes running in given conditions, have only a low description value. Consequently, it is high important to require continually the synthesis of all the obtained knowledge, their mutual linking and interactions. Only such an access allows us a better understanding of such complex processes as the ones running in the nature. The final results can be of existential importance for the human itself.
Table 4
Absolute minimum of temperature at EIS (°C) in 1998-2003

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