

SIBERIAN LIME AS CLIMATE INDICATOR OF ALATAUSKO-SHORSKY UPLANDS

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Abstract: In this article are represented the results of the dendroclimatic researches in the Kuzedeevsky relict Lime island (the southern part of Alatausko-Shorsky uplands). Data on correlation of annual growth of Siberian Lime with average monthly air temperatures are provided. Dendroscale built on the basis of annual rings of Siberian Lime, is able to reconstruct the climate dynamics of Alatausko-Shorsky uplands for the last centuries.

Keywords: Alatausko-Shorsky uplands, annual rings of trees, average monthly air temperature, dark taiga, dendroclimatic researches, dendroscale, Mountain Shoriya, reconstruction of climate dynamics, Siberian Lime

Introduction:

The nature of Kuznetsk Alatau and Mountain Shoriya making Alatausko-Shorsky uplands is characterized by a big variety and extreme complexity. Among a black taiga in the Kondoma river basin (Tom river basin) the special attention is drawn by the Kuzedeevsky relict Lime island – a site of the lime wood, having the square about 11 thousand hectares. The lime island is a peculiar copy of tertiary turgay forests which were once growing across all Siberia. The area of Siberian Lime (*Tilia sibirica* Fisher ex Bayer) is unique; it is the only formation in Siberia of the broad-leaved wood in which the whole complex of grassy nemoral relicts numbering 26 types remained (Buko et al. 2009; Krapivkina 2009). Still in literature there is no explanation of the reasons of

safety of this site of limes in the south of Siberia in the period of the last glaciations.

Materials and methods:

The method of dendroclimatic researches is used in our work. Since 2002 to the present some short expeditions to the Lime Island have been organized for sampling and direct field supervision. Participants of expeditions were pupils in the senior classes attending the geographical profile at Novokuznetsk 73 secondary school. Significant help in the carrying out of researches was given by students-geographers of the Kemerovo State University.

Results and discussion:

Identifying the clear communication between the gain of a year of ring limes and the air temperature was the main goal of our researches. As we assumed that a limiting factor of lime growth is the temperature in

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the vegetative period during which there is the main growth of trees in thickness. It allowed us to open a riddle of existence of a phenomenon of Lime island in the South of Kemerovo Region, to confirm (or to disprove) the existence of microclimatic anomaly here.

Dendroclimatic researches have the greatest value in those areas where observations with the help of tools over climate were hardly conducted. The territory of the Kemerovo region has been under such researches. We highlight note that within Alatausko-Shorsky uplands the dendroclimatic method was hardly applied (Adamenko and Ivanov 1983). The maximum age of lime trees according to researches Hlonov is equal to 300 years (Hlonov 1965). Therefore, in case of construction of reference dendroscale, there is a possibility of reconstruction of dynamics of climate of Mountain Shoriya throughout the last two-three centuries.

During expeditions three saw cuts from a trunk of Siberian lime at height approximately a half a meter from a soil surface were selected. There were trees of small diameter (up to 15-20 cm), without external signs of damages of crown and with good reactivity (alternation of narrow and wide rings). Samples were selected on a watershed ($h \approx$ of 360 m), under bed curtains of the wood, near the place of confluence of Malaya Tesh river in the Kondoma River, on the western border of the Lime island (geographic coordinates are the following: $53^{\circ}19'$ of northern latitude and $87^{\circ}15'$ of east longitude). After drying and polishing the saw cuts, the width of each year ring was measured on 4 radiuses. The results were averaged for each sample. The special lens (HORIZON 10x by KMZ) was used to the measurement of increment and applied MPB-2 microscope for measurement of especially thin rings. Averaged quantity of annual growth was compared with the corresponding average air temperatures of various months of the vegetative period.

It was revealed by us that in separate years the quantity of annual growth is only 1-2 layers of cells; it is very unusual for these species of wood. The quantity of annual rings on a small saw cut (diameter 12 cm) is about 60. Thus, we established that these trees were in a depression.

As a whole, the curve of growth was synchronous with the average monthly air temperature (in May-August). Thus the correlation coefficient was very high: $r = 0.7 \pm 0.1$.

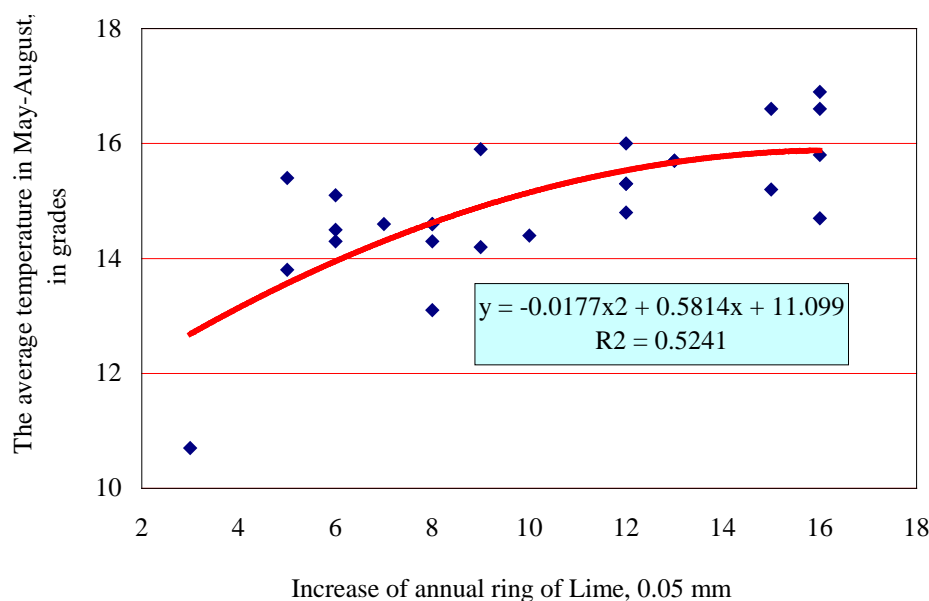
It is worth noting that the reaction of limes is most precisely during the coldest years (as it was observed, for example, in 1969). We received quite satisfactory results also on the monthly average temperatures in-between June-July (correlation coefficient is $r = 0.54 \pm 0.13$). These months are most productive for thermophytes; during these months the tree reserves the greatest part of nutrients for the forthcoming winter.

Having established a correlation connection between lime growth, we could construct the dependence schedule (a polynomial trend) and calculate the width dependence formula of lime annual ring from average monthly air temperature during the warm period of year (Ivanov 2011) (Fig. 1).

Conclusions:

Using this formula, we have had an opportunity to carry out the analysis of the warm months' dynamics in the last hundreds years on basis of model trees' annual growth (having a stable relation with air temperature).

The problem of dendroscale specifications, characterizing the climate dynamics within the South of Alatausko-Shorsky uplands on the basis of Siberian lime's annual rings is our aim for further researches.

Figure no. 1 Dependence of increase of Siberian lime from average monthly air temperature**Rezumat:**

**TEIUL SIBERIAN CA INDICATOR
CLIMATIC ÎN REGIUNEA MUNTOASĂ
ALATAUSKO-SHORSKY**

În acest articol sunt prezentate rezultatele cercetărilor dendroclimatice asupra teiului relict din Kuzedeevsky (în partea de sud a regiunii muntoase Alatausko-Shorsky). A fost realizată corelația dintre creșterile anuale la teiul siberian și temperaturile medii lunare. Scara dendrologică ridicată pe baza inelelor anuale de la teiul siberian poate conduce la reconstituirea dinamicii climatului din regiunea muntoasă Alatausko-Shorsky din ultimele secole.

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