

DEVELOPMENT AND TRENDS OF DENDROCHRONOLOGY IN LITHUANIA

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Abstract

The review of the dendrochronological and dendroclimatological research conducted by Lithuanian researchers since 1953 up to now (during 45 years) has been discussed in publication. They represents the Lithuanian School of dendrochronology also with the development and trends of dendrochronology in Lithuania in the near future. The researchers of the dendrochronology was under the organization of the Dendroclimatochronological laboratory founded in Kaunas in 1968 by Dr. Habil. Teodoras Bitvinskas. During the 30 years of the research work, his collaborators of the Laboratory, under the lead of the Dr. Habil. Teodoras Bitvinskas, not only carried out research work, but also, being as a main dendroclimatochronological laboratory of the USSR, organized conferences, published research works and publications, founded the Tree-Ring Data Bank of USSR. The initiator and founder of the dendroclimatochronological research in Lithuania was the well-known researcher - Dr. Habil. T. Bitvinskas. His monograph "Dendroclimatological research", published in 1974 was the first monograph in dendroclimatology all over the World.

Keywords: tree rings, dendrochronology, development, Lithuania

The main kind of trees of our forests through the dynamic of the tree ring increment presents the unique and important information about ecological, climatic and forest site conditions: different widths of the late and early radial increment and density fluctuations. The first dendrochronological research for Black alder stands was made on 1953. The results of this research were presented in Lithuanian foresters journal "Our woods" (Bitvinskas, 1961). Thirty five years have passed and there have been several hundreds of publications of Lithuanian authors about tree-ring research questions.

This article will attempt all these scientific research works, representing the Lithuanian school of dendrochronology and dendroclimatology, to illustrate the development and trends of dendrochronology in the crossroads of traditional science; without a doubt of an applicable nature.

The first broader research on tree radial increment in Lithuania carried out specialists in Forestry. They belonged to the research on forest increment begun by Prof.Dr. Vaidotas Antanaitis in 1960-1962 at the Lithuanian Forest Planning Project and therefore this work had a nature of the ecological and forest research. The Scots pine (*Pinus sylvestris* L.) and Norway spruce (*Picea abies* (L.) Karsten) in a wide area- Varėna, Svencionys, Zarasai, Rokiškis and in other forest enterprises from the driest to the wettest and from the unproductive to the most fertile forest sites were examined. The research gave a good insight in the dynamic of the radial increment in different forest sites. The results of radial increment were made known in a collective monograph-report "Increment of Lithuanian forests in 1959-1965" (Antanaitis, 1965). Later this idea was further developed in the dissertation of T. Bitvinskas "The dynamics and the possibilities of prognosis of the dynamic

of the increment of the Lithuanian pine forests”, defended in Timiriazev Agricultural Academy in Moscow, Russia (Bitvinskas, 1966). The Solar activity and the atmospheric circulation in the 11, 22, 44 and 88 year cycles was shown to be one of the main causes determining the cyclic regularities of the pine increment (11-year cycles in dry and moderately wet sites and 22-year in bogs). It ought to be mentioned, that only ten years later some American scientists (Stockton et al.) admit the sun's influence and its significance in nature phenomena. In his dissertation (Bitvinskas, 1966) and monograph “Dendrochronological research” published in 1974 (Bitvinskas, 1974) T. Bitvinskas also presents simple and suitable methods of evaluating the anthropogenic (e.g. forest drainage) and others (e.g. zoological) activities.

On January 1968 Dendroclimatochronology laboratory was established at Botanical Institute of Lithuanian Academy of Sciences. This group has been successfully working in Lithuania and abroad. In 1968 the first joint dendrochronological and dendroclimatological meeting in the former USSR took place in Vilnius (Kairiukstis, 1968). This meeting was attended by over twenty various specialists in the fields of physics, biology, climatology, forestry, archaeology etc. A world known authority academician Boris Konstantinov from Russia (one of the creators of the hydrogen bomb), participating in the conference stressed the importance of the trends of the science and the interesting perspectives in the possibility to research nature's extremes in tree rings, using the radiocarbon method. Lithuanian scientists - L. Kairiukstis, A. Juodvalkis, and V. Scemeliovas, presented reports. T. Bitvinskas suggestions to research fossils of pine stumps from upland and moderately high peat-bogs and to create the long-term dendrochronologies, offered during this discussion, were only put into practice thirty years later.

While organizing scientific conferences in the sphere of the dendroclimatological research in 1980, Lithuanian scientists upheld their advanced position in the Soviet Union. In November of 1971 an important conference on radiocarbon in the Earth's atmosphere and the radiocarbon dating problems in Kaunas was held. During this conference, reports were presented by T. Bitvinskas, J. Kairaitis, I. Cerskienė, R. Pakalnis, K. Sulija, J. Banys etc. (Bitvinskas, Dergachev, Kochiarov G (ed.). 1971). Another conference in Kaunas in October of 1972 “Dendroclimatochronology and radiocarbon” in which together with the above mentioned P. Zakarka, E. Maleckas and J. Butenas also participated ((Bitvinskas, Dergachev, Kochiarov G (eds.). 1972).

The first large generalization of separate publications, enlarging the ideas of B. Konstantinov and G. Kocharov appeared in 1970: “Variation of radiocarbon in the Earth's atmosphere and dendrochronological and dendroclimatological research” (Konstantinov, Kochiarov, Jankevicius, Bitvinskas (eds.), 1970). The conclusion of this research states, that this research is very important solving the problems of “Astrophysical phenomena and

radiocarbon", in which they have an interdependent meaning, foreseeing that in the future it might be possible to establish the annual regularities of the climatic changes in Holocene during the last 4-6 thousands years, using the subfossil wood, preserved in peat-bogs and alluvial deposits of the rivers. These ideas were also emphasized in July of 1975, during the second Botanical Congress in Leningrad; here there were many foreign scientists, who participated in the symposium "Biological foundations of the Dendrochronology" (Bitvinskis, 1975).

A symposium entitled "Biological foundations of the Plant life rational use, change and preservation" took place with the approval of the Science Council of the USSR Academy of Sciences. In the session in Tallinn (1974) a commission of Dendroclimatological research was confirmed and L. Kairiukstis, the academician of the Lithuanian Academy of Sciences became its president; T. Bitvinskis was assigned to be the substitute. The commission comprised of famous foresters, biologists, archaeologists and geographers such as: A. Molchanov, G. Gortinskij, B. Kolchin, G. Komin, S. Shijatov, M. Rozanov etc. This commission and its leaders stimulated Dendrochronological and dendroclimatological research in Soviet Union. Conferences were organized and special articles were published. Dendrochronology Meetings took place in Tbilisi (1973, 1976), Conferences - in Irkutsk (1987) and Sverdlovsk (1990). Consultations for dendrochronology and dendroclimatology in Kaunas every year were organized. At the same time in Lithuania the complete research on forest increments in the Lithuanian Agricultural Academy's Faculty of Forestry had been carried out by V. Antanaitis (Antanaitis, Zagreev, 1969; Antanaitis, Juknys, 1978 etc.).

The first dissertation in the field of dendroclimatology was prepared and defended by Irena Cerskiene in Lithuanian Agricultural Academy (Cerskiene, 1975).

Having been approved by the research commission and with the financing of the Institute of Botany of the Lithuanian Academy of Sciences, the Dendroclimatochronology Laboratory in Kaunas (Laisvė et al. 53) was established on January, 1968. The first scientific publication series, whose three last volumes were entitled "Climatic changes in time and space and tree-rings" were published (Bitvinskis (ed.), 1978, 1981, 1984, 1987). The second series became analogous with the USA publication "Tree-Ring Chronology" and was called "Dendroclimatological scales of Soviet Union" of which there were four volumes. They contain series of annual radial increment (chronologies) not only from Lithuania, but also from the other regions of USSR. Teodoras Bitvinskis edited both series.

The four volumes contain 231 chronologies of Lithuanian scientists (11 with scientists from the others republics of in mean time former USSR) and 197 chronologies from other regions. 428 chronologies were published in total, some of them - longtime chronologies (over several hundred years). Unfortunately, due to Laboratory status and financial possibilities changing the publication of mentioned series was discontinued.

Denrochronological Data Bank of Soviet Union was established in Kaunas in 1980. Catalogue of tree ring data was prepared and published (Stravinskiene, 1989). The main authors of Lithuanian chronologies were: J. Kairaitis (111 dendroscales), V. Brukštus (49), T. Bitvinskas (101), V. Stravinskiene (99), J. Karpavicius (28), J. Balciunas (14), L. Kairiukstis. Many famous scientists from the former USSR included their chronologies, such as: B. Kolchin, S. Shijatov, V. Kolishchiuk, G. Komin, P. Feklistov etc.

In the collections of articles, dendrochronological achievements of Lithuania and other regions were presented.

Information became more plentiful due to more personal contacts with scientists of foreign countries. For this we must be grateful to the leaders and workers of the Lithuanian Academy of Sciences Central Library. They started to send up to 150 copies of our publications to the foreign Dendrochronology centers. Thus it is not at all surprising, that with the accumulations of scientific literature it was possible to publish a world bibliographic index "Dendroclimatochronology 1900-1970" (published in 1978 by the Central Library of the Lithuanian Academy of Sciences, bibliographer- A. Sitnikaite, scientific advisor - T. Bitvinskas). This publication contained 2112 works in the original's language, having names and the index of the researched tree species also with a geographic characteristics (Sitnikaite, 1978). Going a bit ahead we can rejoice and console ourselves that in 1995 the Central Library of the Lithuanian Academy of Sciences and bibliographer S. Norkuniene prepared a bibliography "Dendroclimatochronology 1971-1980". It contains significant 2616 works for our specialists. However this index has not yet been published and it seems doubtful of such a complicated and difficult task should be continued in Lithuania, in spite of the foreign dendrochronologists certainly would like to purchase it.

Western scientists have some difficulties learning publications in Russian. Unfortunately, in this language the most of publications of Lithuanian dendrochronologists were written.

Therefore, in the International Dendrochronology Symposium J.M. Fletcher presented a surprise - translation of publications of the Conferences held in Lithuania (in 1968, 1970, 1972) (Linnard, Fletcher (eds.), 1977). After some time in the University of Arizona Tree-Ring Laboratory three volumes English translation of "Soviet publications in dendrochronology" was published in 1993, 1986, 1987. These translations came from our previously mentioned series of publications and conference thesis. T. Bitvinskas monograph appeared in translation in the first volume and only some years later did the author become aware that this had been done.

In Lithuanian Forest Research institute dendrochronological studies started on 1975 (Kapustinskaite, Ruseckas, Stravinskiene, 1977). Vida Stravinskiene defended her doctor dissertation in Moscow, Russia on the topic of "Dendroclimatological analysis of tree

increment in land-reclamation forests of Lithuania” (Stravinskiene, 1981). L. Kairiukstis, J. Dubinskaite-Vencloviene and V. Stravinskiene worked on the ecological prognosis in the base of the research on tree increment cycles (Kairiukstis, Dubinskaite, 1989; Kairiukstis, Vaganov, Dubinskaite, 1990; Kairiukstis, Stravinskiene, 1987 etc.).

In mean time this dendroecological study concentrates in Vytautas Magnus University Department of Environmental sciences (Stravinskiene, 1998; Stravinskiene and Vencloviene, 1998 etc.).

Teodoras Bitvinskas suggested the ecological prognosis, using the influence of the Solar activity. Acad. Leonardas Kairiukstis is noteworthy for consolidating the strength of dendrochronologists and dendroclimatologists in at that time Soviet Union and abroad, especially while working in Luxembourg and Austria, at the Institute of Applied Systems Analysis. Due to his efforts international dendroclimatological research and environmental questions were discussed in Warsaw (1986), Albania (1986), Joensuu (1987) and elsewhere.

Using the gathered dendrochronological material, Teodoras Bitvinskas prepared and in 1984 defended in Sverdlovsk, Russia his doctor habil. dissertation “Bioecological Foundation of the Dendrochronological Research” (Bitvinskas, 1984). That same year, Jonas Karpavicius in Minsk (Byelorussia) defended his doctor dissertation: “Changes of the Individual and Group Radial Increment of Scots Pine in Zone of Mixed Forests” (Karpavicius, 1984). In 1986 at Pulkov Observatory Alexandra Stupneva defended doctor dissertation for physics-mathematics: “Solar activity in the Past and its Dependent Phenomena in the Earth” using for this research the dendrochronological profile of Murmansk -Lithuania- the Carpathians (Stupneva, 1986).

It is impossible to name all the specialists who used dendrochronological methods as a means to research the influence of natural and anthropogenic phenomena. It would be an endless bibliography. One must also not include a broader description of dendroclimatochronological work in the former Soviet Union. In Dendroclimatochronological Lab. in Kaunas this material was being gathered for the USSR dendro-bank and therefore there is considerable material from Caucasus, European Russia, Carelia, Siberia, Far East - Baikal etc. e.g. Mongolia. Thus far all the collected material has not been analyzed and evaluated. Unfortunately, the number of workers has decreased, and even there is help from the computers given by Danish Government, but we barely succeed in solving the arising problems.

Problems and Trends

The Dendroclimatochronological Lab. has a lot of archaeological-ethnographic wood samples, and much of it is already dated. They are the old buildings and castle of Vilnius,

Kaunas and Trakai, wood from old Kernave, wooden Churches from Zemaitija etc. Already some time ago, Vytautas Brukstus compiled a master-chronology of Klaipeda pine, which is used to date Klaipeda old-town buildings (Bitvinskas (ed.), 1984). The work creating the thousand-year-chronology of oak-tree from the previously gathered fossil wood from river Neris old riverbed is of not less importance (Bitvinskas (ed.), 1978). Although not very exact radiocarbon dates, they indicate, that hundred of oak trees drowned in the river from today back to 4000 years BC. Kaunas Botanical Gardens Dendroclimatochronological Lab. Radiocarbon group (chief- senior engineer Algimantas Daukantas) is re-dating the oak tree rings by radiocarbon (^{14}C), using apparatus of "Quantulus-1220". We can almost say, that now there is a kind of competition (and we are loosing in it) with western Europeans, who are finishing a 10.000 year oak masterchronology made from the wood from river Danube, Vessel and alluvial deposits of other rivers, even though they started this work later than we. However, much has been achieved.

After a long methodological struggle, requiring all of Dendroclimatochronological Laboratory efforts, scientific collaborator Rutile Piksryte-Pukiene presented a 2200 year duration pine chronology from a stems and stumps of pine wood preserved in a peat-bog of Uzpelkiu tyrelis in Plunge region (Piksryte-Pukiene, 1996; Piksryte-Pukiene, Bitvinskas, 1996; Pukiene, 1997).

All more significant old-trees and stands have been researched in Lithuania and we already know the basic connections of the radial increment with the climatic conditions: air temperature, precipitation, Solar activity and the influence of the forest site. The methodology of multi-year prognosis also with the monitoring of the tree-ring annual increment is carried out. There is data about the synchronies of the tree-rings and agricultural harvest and also the reaction to extreme ecoclimatic conditions, and this is practical and valuable for agriculture.

Therefore, regardless of the present organizational and financial hardships, part of the scientific staff has been preserved, people are working even it slowly but the new generation of dendroclimatologists at Kaunas Dendroclimatochronological Laboratory has been forming (Piksryte-Pukiene, 1996; Pukiene, 1997; Vitas, 1996).

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