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The tree-ring chronology of Scots pine (*Pinus sylvestris* L.) from the Nesvizh castle XVI–XIX cc. in central Belarus

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ABSTRACT

This article presents for the first time Scots pine tree-ring chronology created from historical timber (XVII–XIX cc.) from central Belarus. The chronology includes 59 tree-ring series which were collected from the different wood structures in the Nesvizh castle. This samples show different stages of the castle renovations. The chronology presented in this paper embraces 222 years covering the period between 1608 and 1829.

Introduction

The Scots pine (*Pinus sylvestris* L.) was one of the most widely used species for construction during the last centuries in Belarus (Zagorulski, 1982; Lysenko, 1985). A small amount of English oak (*Quercus robur* L.) and Norway spruce (*Picea abies* (L.) Karst.) in the central and the northern Belarus were also used. The samples presented in historical buildings are distinguished sometimes by their old age (150–200 years). It allows the development of long-term chronologies that could be used for climate reconstruction, dating other historical timbers in the area and dendroecological investigations.

Early dendroarcheological investigations in Belarus were carried out in the 1970s by Kolchin (archeological excavations in Brest and Polotsk) (Kolchin and Chernykh, 1977), then in the 1980s by Rusov and Zagorulski (archeological excavations in Minsk) (Zagorulski, 1982). However, reliable chronologies have never been constructed because of the small amount of samples analyzed, although the archeological excavations and historical buildings in Belarus should provide good material for dendroarcheological investigations.

One of the most suitable sites for dendrochronological research in this country is the Nesvizh castle, which has been designated by UNESCO as the World Heritage Site in 2005 (Figs. 1 and 2).

Today Nesvizh is small pleasant town located near the river Usha in a picturesque area, center of the Nesvizh district, but it is one of the most ancient cultural centers of Belarus. It was the most famous town in the Grand Duchy of Lithuania during XVI–XVIII cc.

The brick castle was founded in 1583 by Nikolay Radzivil, Marshal of Lithuania, and designed by the Italian architect Giovanny Maria Bernardoni (Tkachev, 1977). The Nesvizh castle withstood a siege of the Russians in 1654 and 1659. In 1706, during the Great Northern War, the Swedish army seized the castle and destroyed its fortifications. The castle was later restored in 1720th and underwent several renovation phases in the eighteenth and nineteenth century. During the Soviet Union time, the castle became a health resort, after small renovation. Recent castle restoration started in 2000, but fire destroyed many wood structures in 2002. The restoration is still in progress and provides an excellent opportunity for dendroarcheological investigations of the castle's wooden structure. We collected the wood samples from the different beams and worked out for the first time Scots pine chronology for XVII–XIX cc. in central Belarus, which will help in dating of the different historical timber.

Materials and methods

The Nesvizh castle was rebuilt many times and it was difficult to detect original wood structures. Towers and buildings shown in an engraving from the end of XVI c. were the best candidates for dendroarcheological sampling (Fig. 3). The timber samples (timber disks and cores) were taken from different structures: joist ceiling and roof beams (Table 1, Fig. 4). One disk sawed from each selected beams taken down during renovation. Two cores in perpendicular radii were taken from each selected timber which did not take down. The total amount of the selected beams is 79.

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Fig. 1. The location of the Nesvizh castle.

Fig. 2. The Nesvizh castle's entrance gate.

A timber is well-preserved and it is not difficult to identify original tree species. Microscopic wood anatomy examination was carried out for some samples only. All samples were identified as Scots pine (*P. sylvestris* L.).

The surface of cores and timber disks were sanded with decreasing grain size sand paper (40–600 grids). Tree-rings width was measured to the nearest 0.01 mm. For this purpose, scanned images (1200 dpi) of the timber samples and the ArcGIS program adapted for tree-ring measuring, were used. The timber disks were measured in at least two radii. The tree-ring series were cross-dated by using the COFECHA 6.06P program (Holmes, 1983; Holmes et al., 1986). Synchronization of the tree-ring series was checked by visual comparison of the tree-ring-width graphs.

The intermediate chronologies were constructed for every wood structure. Then each of them was dated by Litpinus-1 chronology (Vitas, 2008) located at distance 150–200 km northwest from the Nesvizh castle. Litpinus-1 chronology includes 65 tree-ring series from many historical buildings and living trees and runs for 516 years between 1487 and 2002. After that the intermediate chronologies were combined into one chronology NSVPIN-1. Standardization of the series was done using the ARSTAN40c program (Holmes, 1983; Holmes et al., 1986). Each tree-ring series was indexed separately and then averaged.

The developed chronology was compared to other chronologies from the neighboring regions: Dannenstern House (Zunde, 1998),

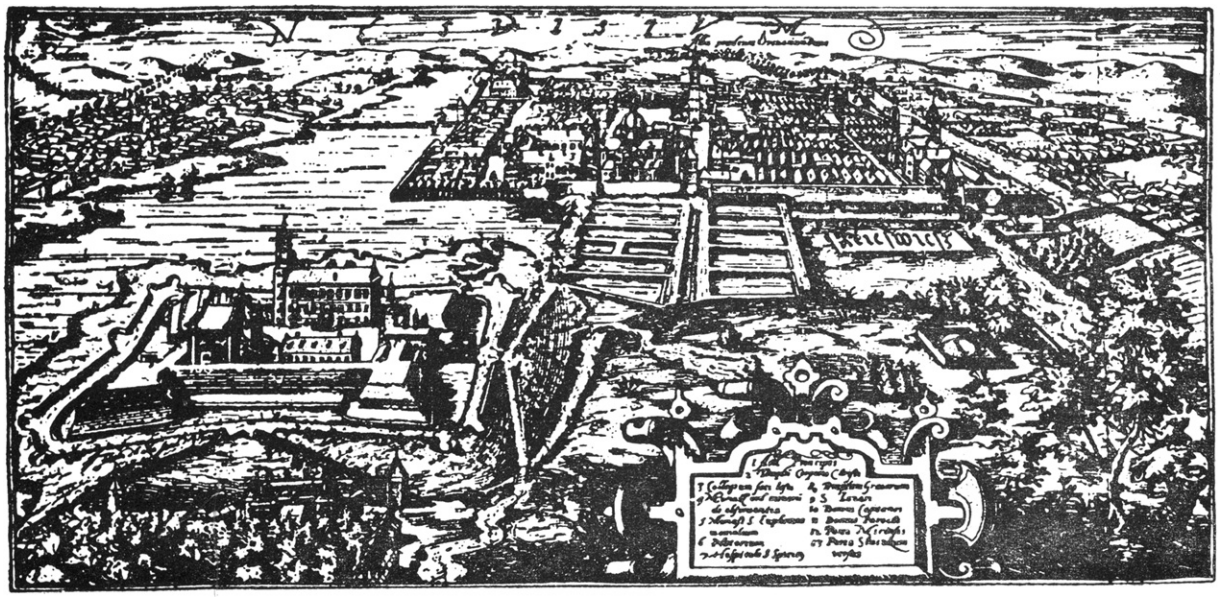

Fig. 3. The Nesvizh castle at the end of XVI c. (the engraving of T. Makovski from Tkachev, 1977).