

Dating of wooden shelters in Polish High Tatras - tree rings records of the shepherding history in Carpathians

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Introduction

Tatras is one of the main regions in Carpathian arc where seasonal pasturing on meadows located above timberline has been developed since 16th century. Over a period of centuries, Wallachian shepherds moved across mountains permanently transforming the natural environment, economy and culture of the Carpathians (Hołub-Pacewiczowa 1931, Dobrowolski 1970). In many locations, new openings for pastures were established and the treeline was driven back as a consequence. In this paper, the results of the systematic dating of shelters, the first project of this kind in the Tatras, are presented. Although shelters are located in many parts of the Carpathian Arc (Western Tatra Mts., Gorce Mts., Beskid Żywiecki Mts., Beskid Mały Mts.), those from High Tatras region are the most numerous and well-known for the historical and cultural value.

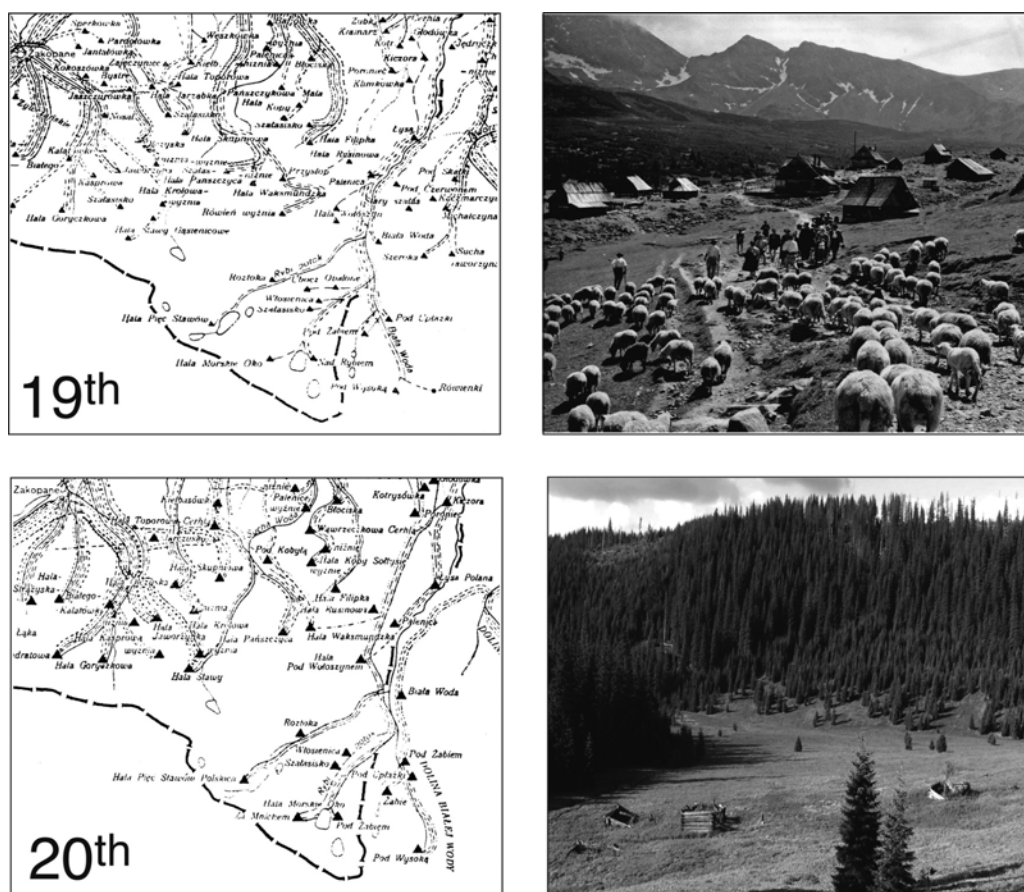


Figure 1: Changes of shelters distribution in High Tatras during 19th and 20th centuries.

Lately studies on the highest preserved remote shepherds' architecture have a special importance. Despite the fact that in 1978 High Tatra's wooden shelters were accepted as monuments of cultural heritage, the number of them has decreased four times in the last century (Fig. 1), mainly as a result of lack of proper maintenance. Shepherds' buildings are no more used since pasturage in the Tatra National Park became restricted

Material and methods

In total, 26 shelters from 10 glades (from elevations 1000 - 1900m a.s.l.) were investigated (Tab. 1). Standard techniques for sampling and dating of historical buildings were used (Ważny 2001). Approximately 10 samples were extracted from each shelter, though the number of core samples varied from 3 to 17, due to differing range of timber preservation. Cores were taken from both walls and roofs. Beams with bark and high number of rings were predominantly chosen for sampling. The wood species identification revealed that only norway spruce (*Picea abies* K.) has been used for construction of studied buildings. Hence the existing 400 years long spruce chronology (Kaczka & Büntgen 2006, Büntgen et al. 2007) was employed for cross-dating. Dating was carried out by visual cross-dating and statistically verified using COFECHA program. The criteria of dating depended on series length and value of correlation coefficient. Two conditions were recognized as necessary for confident dating (Cofecha output file):

- 1) >75 rings, cc=0,3281, max. 1 possible problem 2) 50-75 rings, cc=0.5, 0 possible problem

Cross-sections with less than 50 rings could not be dated with confidence.

Table 1: Geographical settings and amount of analysed samples.

Glade name	Number of shelters	Number of samples	Altitude [m a.s.l.]	Type of the forest
Olczyńska	2	37	1035 - 1110	Lower montane forest
Jaworzynka	4	60	1065 - 1195	Lower and upper montane forest
Rusinowa	2	24	1180 - 1300	upper montane forest
Kopieniec	7	66	1210 - 1250	upper montane forest
Królowa	2	25	1230 - 1270	upper montane forest
Roztoka	1	4	1300	upper montane forest
Pańszczyca	1	14	1360 - 1440	upper montane forest
Waksmundzka	2	23	1364 - 1400	upper montane forest
Gąsienicowa	4	52	1480 - 1540	upper montane forest
Dol. Pięciu Stawów	1	5	1625 - 1900	Dwarf pine belt

Results and discussion

From all 310 samples, 57% have been successfully dated. The relatively low number of rings per sample and the condition of wood were the main problems of accurate cross-dating. The oldest wood belongs to one of the shelters located in Polana Kopieniec and dated back to 1756. Three more objects from the 18th century were dated. The variety of dates for individual shelters suggests that repairs and renovations occurred often during their lifetime. Differences in buildings age have been found in spite of their similar appearance (Fig. 2), the architectural form being inherited from a tradition that lasted at least two centuries



Figure 2: Differences of the age of the oldest beams dated within one glade (Kopieniec Glade 1230m a.s.l.)

Dendrochronological results correspond with historical documents about the evolution of the shepherding in Tatras. First mention about that activity occurred in 14th-15th centuries, but the oldest wood samples have been dated back to the 18th century. Tree ring records of shelters foundation and repairing can be linked with some important historical events (Fig. 3):

1. Period of industrial revolution can be noticed as decline of sheep farming (the emigrations from Tatra and Podhale region, decrease of wool prices as a result of competition with wool imported from Australia),
2. During First and Second World War, economical crises and restriction in emigration stimulated pasturing as a source of basic supplements (wool, milk, meat),
3. The establishment of the Tatra National Park and restriction of pasturing due to protection of natural remains of high-mountain environment in 50s and 60s of 20th century,
4. Extensive pasturing and renovations of shelters as a preservation of cultural heritage organised by Tatra National Park and The Department of Monuments Conservation of Tatra Museum.

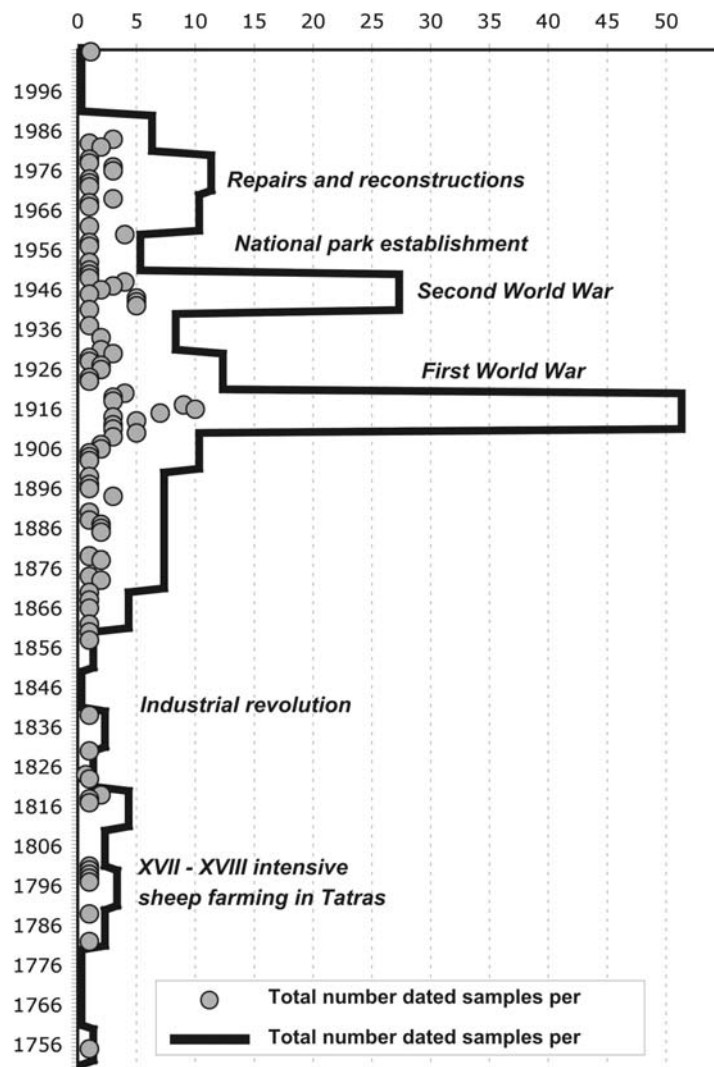


Figure 3: Tree-ring records of shelters foundations and renovations as proxy of human activity in high-mountain environment during last 250 years.

Eight local chronologies from historical wood was constructed and compared with master chronology (Fig. 4). The longest chronology was constructed for Kopieniec Glade spanning 1681-

1968 period (1716 -1968 after truncation < 5 series). To assess the origin of timbers used for shelters construction, the relationship between elevation of glades and correlation between site chronologies and master chronology was studied. The master chronology was constructed based on 477 individual series from several timberline sites within entire Tatras (Kaczka & Büntgen 2006, Büntgen et al. 2007). The correlation coefficient varied from 0.413 for Rusinowa Glade up to 0.780 for Waksmundzka Glade. A significant relationship between sites elevation and correlation against master chronology is found ($r^2=0.63$, $p=0.034$) after excluding Rusinowa Glade, the shortest chronology. The very complex situation of land possession in this region suggested that for some sites, wood could arrive from other, including lower, locations. The comparison between dated beams and master, high-elevation chronology, confirm use of local timbers. The samples from historical wood of known provenancy can be included to regional chronology and improve its statistical parameters as was reported from high-elevation sites of Loetschental, Alps (Büntgen et al. 2006).

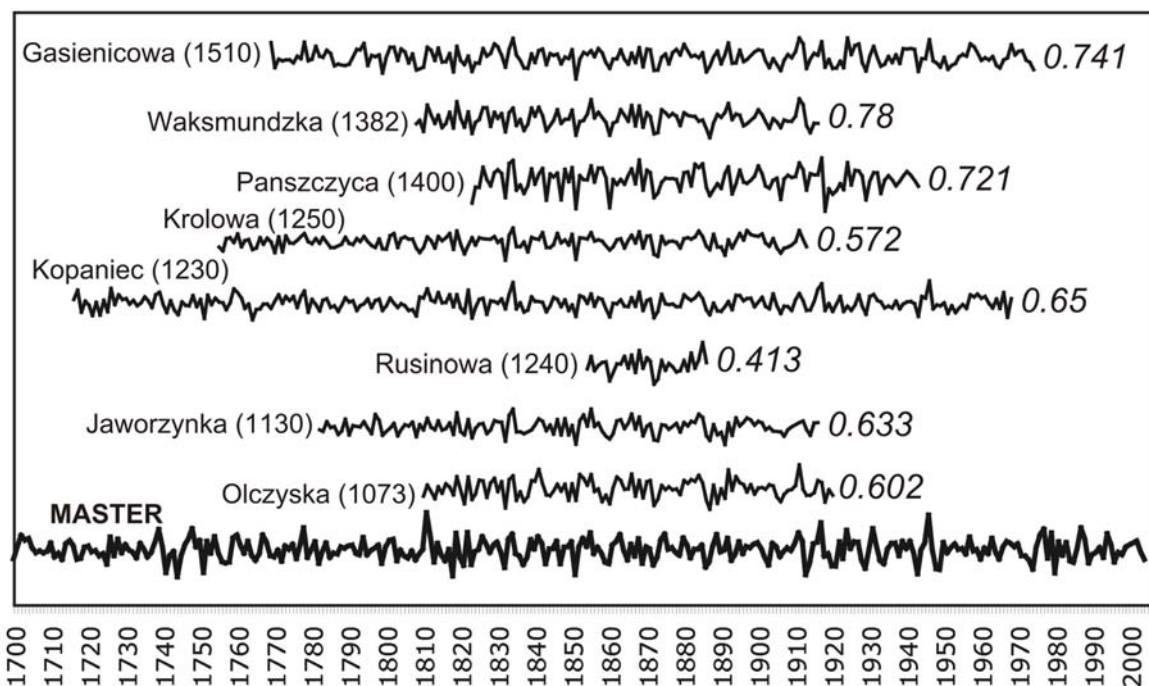


Figure 4: Local chronologies constructed using historical wood from 8 locations. The significant relationship between site elevation (m. a.s.l., in brackets) and correlation coefficient (*italic*) with high-elevation master chronology proves local origin of the wood.

Conclusions

1. Results obtained from dendrochronological dating have shown that preserved shelters are older (18th century) than previously evaluated by ethnological investigations (19th - 20th century) (Szafer 1966).
2. Though tree-ring dates are limited to the period of last 250 years and vary within each building, the general age structure reveals a significant relation to particular stages of expansion and restraint of human activity in the High Tatras.
3. Tree-rings proxies of past events are, in some cases, more pronounced than other historical documents.
4. Further analyses of relationships with climate dynamics and historical events can be provided for better understanding of natural and anthropogenic changes of alpine environment in the Carpathians.

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