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The review of the Ph.D. thesis of Mgr. Jakub Kaspar "The influence of the wind on treeline position – the question of summit syndrome".

The Ph.D. thesis of Mgr. Jakub Kaspar entitled "The influence of the wind on treeline position – the question of summit syndrome" is an addition to the long-persuaded scientific effort to understand the functioning of the mountains treeline. The boundary between subalpine forest and treeless space above, as one of the most important elements of mountain environment is also one of the most studied natural landscape phenomena. The treeline has been studied, especially in Europe for at least two centuries thus the attempt to enhance the existing knowledge constitutes a great challenge. The importance of temperature, relief, geography (size and location of the mountain), geomorphic processes was thoroughly elucidated in hundreds of academic papers and numerous books. Therefor what we don't know about formation and functioning of treeline is very important question. Actually closer examination reveals that a lot of questions remain without answer and some of them haven't been asked yet. The doctoral thesis of Mgr. Jakub Kasper has compile the researches addressing some of these questions in refreshing way and also ask new ones.

Author focused on region of Central Europe, which is less studied than "classical" treeline locations such Alps, Scandinavian Mts etc. The other innovative way of conducting study was to tackle the role of factors outside of the most popular range of scientific interest while studding treeline ecotone. Both the role of the wind and influence of the summit syndrome fell into category of rarely investigated causes shapping the treeline in site and regional scale.

Seven main chapters and appendix compose the thesis. The structure of the thesis is traditional and contains all required elements including introduction, review of the selected literature, characteristics of the study site, material and methods, results described in four original papers, conclusions, and references. The supplementary chapters reveal the author's contribution and specification of the author share.

The main body of the thesis is constituted by three published and one submitted paper. All published in highly ranked scientific journals covering fields of climatology, biology, biogeography, dendrochronology.

The general remarks

The mains shortcomings of the thesis:

1. The introduction presents amount others the definition of the treeline, main factors driving the treeline position and character. The chapter is crucial because author stated the aim of the dissertation there. The main goal of the research is "to describe the influence of wind and summit syndrome on treeline". Although four detailed goals are also listed the scientific aim of the entire thesis is pretty vague.

The literature review presents the definition of the basic terms and treeline research state of art based on very selected publications. The main hypotheses explaining the formation of

treeline are well characterised but the thesis would benefit from more comprehensive characterisation of the water conductivity, tapering and other physiological features because we can link them with climate parameters and they can help to explain the role of wind as limiting factor of tree growth.
Author described the physiology, primary and secondary growth of the coniferous trees as key information necessary to understand the functioning of the tree in treeline ecotone. The climatic factors, namely temperate, snow and wind is discussed in following chapter. The topic of the thesis is directly related to climate influence on treeline therefore the very brief characterisation lacks a lot of important information e.g. the role of precipitation (Ohse et al 2012), winter temperature (Kullman et al 2007), windthrow (Zong et al 2014). It is difficult to understand why the recruitment, relief and topography, mountain range size, summit syndrome and human intervention were grouped together under title "supplementary factors…". The list is incomplete, lacking for instance the biological factors (including very prominent in Carpathians bark beetle outbreaks) and already mentioned windthrows.

2. The human activity has influenced the treeline ecotone of all mountains in Europe including all 11 research sites. The complex processes including logging, grazing, changing the species composition, air pollution, climate warming, increasing the concentration of CO_2, Nitrogen and other gasses can not be neglected while discussing treeline ecotone characteristics in 20th and 21st centuries. The research wasn't performed in the primary forest but in the landscape influenced by people for centuries. This fact wasn't taken in consideration in most of the studies as a potential explanatory factor of analyses. In the end in two cases ("How wind affects growth in treeline Picea abies" and "Relation between tree growth and temperature explains formation of regional treelines") author tried to explain some of the findings by past human impact. This is logical and would be more sounded if the human influence was presented in full extend in earlier chapters.

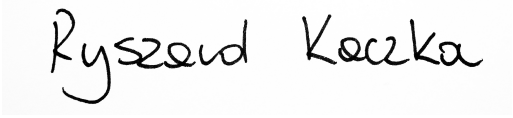
3. Author selected 11 sites located in Harz Mountains, Sudetes and Carpathians. It covers vast part of so-called Central Europe but also raise some questions. The term of CENA is poorly defined and selection of the site is not well explained. Author reveals that one of the main motivations was the good accessibility of the sites. This is a clear and understandable criterion considering the requirements of xylogenesis studies. Notwithstanding the general criteria of the site location is not stated and since they are not obvious this is one of the weakest points of the discussed thesis. Several mountain ranges were excluded (Black Forest, Bavarian Forest, Sumava Mts etc.) without mentioning them in whole work. The Harz is very awkward choice since this location is far from the main area of interest – Sudetes and Carpathians, the latitudinal location is so off comparing with ten other sites, and also the natural character of the treeline could be question.

4. It is difficult to judge already published work but it is also difficult to overlook one potential problem concerning the analyses of the climate influences on 11 studied sites. The different characteristics of trees were collected in the field in period of 2010 (?) – 2014(?). The employed climate data covers 1960-1991 period. This means the the identification of the uppermost tree location and the entire field measurements were performed 20 – 25 years later than temperature and precipitation data were collected. The question arise how accurate one can define the climate influence on the treeline using climate data 20-25 years off comparing to treeline measurements. It is easy to adjust such timelines in case of tree-ring analyses but how this was corrected for features like location, elevation etc. The proper procedures of defining such parameters can be performed using historical aerial photos. It is necessary since

the recent dynamics of treeline and therefore changes of the treeline location in Carpathians can be very significant (Spyt et al. 2015, Kaczka et al. 2015, Guzik 2010).

The main accomplishments:
The results are presented in fur separate papers covering case study of the xylogenesis in Giant Mts., the detailed study of the wind affect on the spruce growth in the Giant Mts, and two papers dealing with different aspects of functioning and external factors driving the growth of the spruces in treeline ecotone in so-called CENA.
1. The first chapter of the results, the study of the differences in intra-annual wood formation of spruces in treeline and timberline is in my opinion the most valuable part of the thesis. The research contributes in understanding how trees growth in treeline ecotone in Central Europe and what are the main deferences between cambium activity and wood formation in most extreme environment where singular trees exists and most upper limit of the subalpine forest. This has an high scientific valus but also creates a good background for next chapters.
2. The second part of the results in dedicated to unveiling the wind affect on the growth of the trees in treeline. This part of the work is addressing directly the main goal of the thesis. The site was well selected since Giant Mts are one of the windiest mountain ranges in Europe. The amount of collected field data is very impressive and conducted analyses are adequate to the undertaken task. Considering the limited data on actual wind direction and speed available for discussed research the results provide valuable assessment of the results of wind activity.
3. The analyses of 11 sites including in three following papers include pioneer attempt of providing the thermal indicators of treeline environment and explain the regional characteristics of the treelines. Although the results are based on limited number of sites not covering in representative way whole studies region author made a effort to draw some general patterns explaining the treeline functioning in Sudetes and Carpathins. Here the above mentioned shortcoming of the discussed research – lack of proper climate data should not diminish the contribution of both papers.
4. It is also worth mentioning that the conclusions were composed based only on findings presented in the four papers with attention to the facts and without indulging in too much interpretation. Author provides the final thoughts and take-home message with mature self-restraint and respect to outcomes of his work.

The overall evaluation
The thesis tackled important scientific problem of creating more complete picture of the dynamics and factors controlling treeline ecotone. Author undertook difficult task of assessing how wind is affecting the growth of the trees at the limits and if the summit syndrome can explain some of the treeline characteristics. He made a very huge amount of field, lab and analytic work dedicated to improve understanding of mains factors shaping the treeline ecotone in Central Europe. Althought the dissertation thesis is not free from shortcoming, which is normal part of the scientific process the work constitute an important scientific accomplishment. Each of the academic papers and the thesis as a whole work clearly proofs that Jakub Kaspar exhibits the virtues of mature scientist and deserves the Ph.D. degree.



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