

Submission of the research project

from the Faculty of Biology and Environmental Protection

for admission to PhD studies “Academia Copernicana” in academic year 2019/2020

1. **Project title:** “Xylem plasticity in response to long-term climate change”
 2. **Supervisor:** dr hab Marcin Koprowski
 3. **Abroad attendant:** dr Jozica Gricar (Forestry, Slovenian Forestry Institute, Ljubljana)
 4. **Subsidiary supervisor:** dr Aleksandra Pospieszynska, Wydział Nauk o Ziemi UMK (Earth Sciences)
 5. Disciplines within project will be realized (basic and supplementary): Basic discipline: biology, Supplementary discipline: Earth Sciences
 6. **Project abstract:** Trees as long-living organisms react to environmental changes and “archive” the effects of those changes in the structure of tree rings. They can also be dated to a specific calendar year and subdivided by cell structure for studies of seasonal response. The aim of our project is to study the tree response to climate change within the last 1000 years. Understanding basic questions about xylem plasticity in trees is of special importance given current concerns about drought induced tree mortality across the globe (Hoffmann et al., 2011). The measurements of selected cell parameters, which we plan to study, also serve as a source of information about wood density (Rathgeber, Decoux, & Leban, 2006). Willson et al. (2008) proved the strong tendency for dense wood to be more resistant to cavitation than light wood. We want to extend this study back in time using historical wood and check whether the tendency for dense wood is more common now, during observed climate warming, than 500 hundreds years ago. In addition to the living oak and pine trees, we also already have access to some historic material via the Department of Ecology and Biogeography of Nicolaus Copernicus University. Basic tree-ring parameters will be obtained from the measurement of ring widths to the nearest 0.01 mm using. Next, samples will be taken for microslide preparation according to the methodology proposed by Schweingruber, Börner, and Schulze (2006). Cell measurements will be done with a light microscope and an adequate system for image analysis. Selected cell parameters of coniferous trees which will be taken into account are: average lumen area (ALA), average lumen diameter (ALD); cell wall thickness (CWT); hydraulic conductivity of early wood (Cond.E); Wall thickness of the 90th percentile of latewood (Q90 (WALLL)) (Liang et al. 2013, Bryukhanova and Fonti 2013). For ring porous trees, earlywood vessel, average and total density and the percentage of water conductive area (total earlywood vessel area/tree-ring area) will be calculated for: (i) the first row of vessels (FREW); (ii) all earlywood cells (EW); and (iii) cells with area above 0.05 mm² (AEW) (Koprowski et al. 2018).
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