

<b>Tytuł projektu</b>
Plastyczność komórek ksylemu jako odpowiedź na długoterminowe zmiany klimatu.
<b>Project title</b>
<b>Xylem plasticity in response to long-term climate change</b>
<b>Dyscyplina /Area of science</b>
Nauki biologiczne
<b>PROJECT DESCRIPTION</b>
<p><b>Project goals</b></p> <p><b>In this study we want to use the cellular development of tree-rings to fill in this missing gap for climatic construction by defining the intra-annual resolution of climate parameters across the past 1000 years in northern Poland.</b> The techniques to be used have been demonstrated to have excellent potential for intra-annual climate reconstruction in both deciduous ring-porous trees (Arsalani et al. 2018) and coniferous trees (Ziaco et al. 2016).</p> <p><b>Outline</b></p> <p>Whereas whole tree ring analysis offers yearly resolution, analysis of cell parameters or wood density allows us to increase the resolution of the acquired information archived in the tree ring patterns to seasonal reconstructions. The study of the effect of climatic variables on the within-ring density profiles for instance proved that the first part of the ring that grows is influenced by hydric variables while the last part of the ring is more strongly affected by temperature than hydric conditions (Franceschini et al. 2013). Understanding such subtleties will be extremely important in judging how forests may respond in future climate change scenarios as well as for creating much more detailed records of past response attuned to particular seasonal variables. One example of how sub-annual changes in cell structure might be particularly valuable is in studying extreme events such as short term floods, droughts or frosts. Such events, occurring within a year might be masked in records which use whole-ring parameters, but establishing periodicity and connections with impact on societies is very important. To assess social impact, the timing of extreme short term events like frost or flood can make a very significant difference to the degree of impact. During the Little Ice Age period for example, extreme events and rapidly shifting climatic variability meant that communities experienced very hard times, with such repeated extremes of frost or flood coinciding with the period before harvest and therefore decimating crops over a number of years, leading to starvation and the weakening of social structure. Wood anatomy will allow us to access information about such events in a way not previously possible or attempted for Northern Poland.</p> <p>This PhD project will be conducted in close cooperation with the Service of Wood Biology, Royal Museum for Central Africa, Tervuren, Belgium and Slovenian Forestry Institute, Ljubljana</p>

### Work plan

1. Critical analysis of existing sample collection,
2. Sample collection
3. Selection of samples for cell anatomical studies
4. Microscope slides preparations
5. Cell measurements
6. Climate and wood anatomical data collection

### Literature

- Arsalani, M., A. Bräuning, K. Pourtahmasi, G. Azizi, and H. Mohammadi. 2018. Multiple tree-ring parameters of *Quercus brantii* Lindel in SW Iran show a strong potential for intra-annual climate reconstruction. *Trees* 32:1531–1546.
- Franceschini, T., F. Longuetaud, J.-D. Bontemps, O. Bouriaud, B.-D. Caritey, and J.-M. Leban. 2013. Effect of ring width, cambial age, and climatic variables on the within-ring wood density profile of Norway spruce *Picea abies* (L.) Karst. *Trees* 27:913–925.
- Ziaco, E., F. Biondi, and I. Heinrich. 2016. Wood Cellular Dendroclimatology: Testing New Proxies in Great Basin Bristlecone Pine. *Frontiers in Plant Science* 7:1602.

### Required initial knowledge and skills of the PhD candidate

- ➔ Analytical thinking
- ➔ Eager to learn
- ➔ Understanding of dendrochronology
- ➔ Knowledge about wood anatomy (critical for cooperation with international partners)
- ➔ Understanding of basic climatology
- ➔ Ready to go abroad for 3-6 months traineeship or study within the Erasmus+ or other programme.
- ➔ Eager to work hard

### Zgłaszający projekt/ Author of the project

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Wydział Biologii i Ochrony Środowiska UMK

jednostka organizacyjna

### Proponowani promotorzy i mentorzy/prospective supervisors

1) promotor główny/ main supervisor

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2) promotor pomocniczy / co-supervisor	
dr Aleksandra Pospieszyńska	