

1. PHD PROJECT DESCRIPTION (4000 characters max., including the aims and work plan)

Project title: Impact of Monsoons on Tree Rings and Xylogenes of Selected Tree Species in the Tropical Climate of Southeast Asia

1.1. Project goals

[Current studies](#) shows that land monsoon rainfall will increase in South Asia and East Asia with high confidence. The rainy season will likely be lengthened in the Northern Hemisphere due to late retreat (especially over East Asia). The main aim of this project is to study the effect of climate change on tree rings and cambium activity in tropical monsoon zone of Southeastern Asia. We hypothesized that change in length of rainy season may lead to increase the growth of trees what can be visible in the width of tree rings. It was also hypothesized that the late retreat of rainy season may lead to changes in cambium activity and to extensions of the termination of cells division with the highest number of cambial cells in October rather than observed September in 2018 and 2019 ([Pumijumng et al 2021](#)).

1.2. Outline

Thailand's climate, a subtropical monsoon climate, is influenced by the Asian monsoon system and is characterized by remarkable differences in rainfall and air temperature across the seasons and within subseasons. Monsoons shapes the vegetation of the region. In forests of Southeast Asia is observed clear seasonality with wet and dry seasons. Tropical mixed or monsoon forest, typically contains a high number of tree species but only some of which drop some or all of their leaves during the dry season, what may suggest that majority of the trees did not create yearly rings. Previous study shows that cambium activity of *Tectona grandis* (L.), *Pinus latteri* and *Pinus kesiya* depends on seasonality. It means that one tree-ring is crated during one wet season. Yearly cambium activity is crucial and promising for conducting research in tropical climate and gives number of opportunities to study the effect of climate change on trees in Southeast Asia.

1.3. Work plan

The work plan includes the collection of samples during the upcoming field campaign in June 2024. These samples will be taken to the Department of Ecology and Biogeography of the Faculty of Biological and Veterinary Sciences at NCU. Samples for xylogenes will be collected throughout 2024 and will continue to be collected in the following year by the foreign supervisor, Professor Nathsuda Pumijumng. The samples will be sent to Toruń. During the academic year 2024/2025, the student will work on samples collected in June 2024 and for xylogenes throughout 2024. The next set of samples will be sent to NCU at the end of 2025. Laboratory work will be completed by the PhD candidate during the academic year 2025/2026. The academic years 2026/2027 and 2027/2028 will be reserved for statistical analysis and publication of results.

1.4. Literature (max. 10 listed, as a suggestion for a PhD candidate)

Puchałka R, P Prislán, M Klisz, M Koprowski, J Gricar - Tree-ring formation dynamics in *Fagus sylvatica* and *Quercus petraea* in a dry and a wet year, *Dendrobiology*, 2024

Inthawong S., Pumijumng N., Muangsong C., Buajan S., Cai B., Chatwatthana R., Chareonwong U., Phewphan U. Growth Response of Thai Pine (*Pinus latteri*) to Climate Drivers in Tak Province of Northwestern Thailand. (2024) *Forests*, 15 (2), art. no. 345

Pumijumng N., Muangsong C., Panthi S., Buajan S., Cai B., Kulsuwan P., Kongsombat P. A 225-year pine (*Pinus latteri*) tree-ring record of pre-monsoon relative humidity variation in Nan province of northern Thailand and the linkage with large-scale ocean-atmospheric circulations (2023) *Global and Planetary Change*, 230, art. no. 104277

Pumijumng N., Muangsong C., Buajan S., Songtrirat P., Chatwatthana R., Chareonwong U. Factors Affecting Cambial Growth Periodicity and Wood Formation in Tropical Forest Trees: A Review (2023) *Forests*, 14 (5), art. no. 1025

Zuidema P.A., et al. Tropical tree growth driven by dry-season climate variability. (2022) *Nature*

Geoscience, 15 (4), pp. 269 – 276

Preechamart S, Pumijumnong N, Braeuning A, Muangsong C, Cai, B, Buajan S. Inter-annual and intra-annual tree-ring oxygen isotope signals in response to monsoon rainfall in northwestern Thailand. Holocene. 2022, Doi: 10.1177/09596836221138352 (Q1, IF= 3.03)

Pumijumnong N, Songtrirat P, Buajan S, Preechamart S, Chareonwong U, hotika Muangsong C. Climate control of cambial dynamics and tree-ring width in two tropical pines in Thailand. Agricultural and Forest Meteorology. 2021; 303,108394 (Q1, IF=4.65)

1.5. Required initial knowledge and skills of the PhD candidate

The candidate should possess a background in xylogenesis studies and experience with wood microslides preparation.

1.6. Expected development of the PhD candidate's knowledge and skills

It is expected that the PhD candidate will enhance their understanding of wood biology and ecophysiology, while also improving their skills in scientific writing and presenting research at international conferences.