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

Project title: The origin of lake basins in the dune area of the Elk Mountains and the evolution of the landscape in their surroundings since the Late Glacial

1.1. Project goals

The main objective of the project is to establish the genesis and palaeogeographical development of the lakes in the surroundings of the dune field of the Elk Mountains.

In addition, a number of research questions are posed:

a. What impact did the migration of dune sediments have on the functioning of the lakes?

b. What is the thickness of the dune sands and their textural characteristics?

c. What soils developed within the study area, and what was the impact of the water bodies on soil formation?

d. When did the water bodies and wetlands in the study area begin to disappear?

e. What area of the Elk Mountains is composed of organic soils?

f. Are there traces in the lake sediments related to human management, and when did they appear?

1.2. Outline

To the north of Grudziadz there is a dune field that has encroached on the upland from the side of the Vistula valley, which has a limited extent towards the east. The field is not particularly large, but there are, among other landforms, well-developed parabolic dunes. The area is currently covered by forest. Climatic changes during the Late Glacial period led to a halt in aeolian processes and the eastward movement of the dunes. After the retreat of the ice sheet during the Pomeranian phase of the last glaciation, extensive sand fields were created. They were a source of fine sand material for the formation of the aeolian belt, part of which is a field in the Elk Mountains (Góry Łosiowe). Between the dunes, there are small bodies of water and peat bogs. Here, the question arises whether the lakes and wetlands are a result of aeolian processes? Or do they have an older origin? If they were formed as a result of aeolian processes then we are dealing here with an extremely rare type of lake bowl, namely of deflationary origin. Therefore, can we speak of a lake district of the aeolian type? In addition, it is necessary to trace the palaeogeographical changes that took place in this area as recorded in the biogenic sedimentary archives. To do this, a number of field and laboratory studies need to be carried out. Among the most important are geomorphological mapping, the collection of (1-3) sediment cores from lake beds or peat bogs with intact structures for further laboratory studies and for absolute dating, reconnaissance of soil cover by hand probing and trenching, and reconnaissance of the thickness of the aeolian sands using GPR with confirmation by hand probe or mechanical probe. Laboratory work will consist of grain size and geochemical analyses of the collected sediments, soil analyses. Palynological reconnaissance will be performed. If the doctoral student has the ability to do so he/she will perform it himself/herself, if not it will be outsourced. The compilation of the results of the field and laboratory work and the study of the literature will allow to establish the genesis of the lake basins, reconstruct the palaeogeography of the area and give answers to the research questions. This will result in a set of 2-3 publications on the basis of which it will be possible to conduct a doctoral defence and award a doctoral degree in the discipline of Earth and Environmental Sciences.

1.3. Work plan

- Literature searches - throughout the duration of the doctoral school
- Fieldwork carried out in autumn and spring - 1st year

• Laboratory research (granulation and geochemical analyses) - 2nd year
• Elaboration of results, statistical calculations, preparation of conference presentations, participation in 3 conferences, preparation of publication texts - 2nd and 3rd year
• Completion of publications, graduation, preparation of dissertation, defence of doctoral thesis - 4th year

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

• Bieniek A., Łachacz A. 2012. Ewolucja gleb murszowych w krajobrazie sandrowym. W: Wybrane problemy ochrony mokradeł, Andrzej Łachacz (red.). Uniwersytet Warmińsko-Mazurski w Olsztynie, Olsztyn.
• DeVries-Zimmerman, S., Fisher, T.G., Hansen, E.C., Dean, S., Bjorck, S., 2014. Sand in lakes and bogs in Allegan County, Michigan as a proxy for aeolian sand transport. In: Fisher, T.G., Hansen, E.C. (Eds.), Coastline and Dune Evolution along the Great Lakes. Geol. Soc. Am., Boulder, CO, Sp. Pap. 508, 111–132. doi:10.1130/ 2014.2508(07).
• Ilnicki P., Szajdak L. W. 2012. Zmiana właściwości fizycznych torfu i murszu w odwodnionych torfowiskach. W: Zanikanie torfowisk, P. Ilnicki, L. W. Szajdak (red.). Wyd. Poznańskiego Towarzystwa Przyjaciół Nauk, Poznań
• Karasiewicz, T.M., 2019. The kettle-hole mire as archives of postglacial changes in biogenic sedimentation (Tuchola Forest, north-Central Poland). Catena 176, 26–44.
• Mirosław-Grabowska, J., Obremska, M., Zawisza, E., Stańczak, J., Słowiński, M., Mulczyk. A., 2020. Biological and geochemical indicators of climatic oscillations during the Last Glacial Termination, the Kaniewo palaeolake (Central Poland). Ecol. Indic. 114, 106301. doi.org/10.1016/j.ecolind.2020.106301
• Zawiska, I., Słowiński, M., Correa-Metrio, A., Obremska, M., Luoto, T., Nevalainen, L., Woszczyk, M., Milecka, K., 2014. The response of a shallow lake and its catchment to Late Glacial climate changes – A case study from eastern Poland. Catena 126, 1–10. doi.org/10.1016/j.catena.2014.10.007
• Zeeberg, J.J., 1998. The European sand belt in eastern Europe - and comparison of Late Glacial dune orientation with GCM simulation results. Boreas 27, 127–139.

1.5. Required initial knowledge and skills of the PhD candidate

Completed degree in earth and environmental sciences. Preferred ability to work in a laboratory and field work in Quaternary glacial and postglacial sediments. Ability to work in a GIS environment.

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

Ability to conduct scientific research, conduct scientific discussions. Writing articles. Analysing and making inferences from a variety of environmental data. Creating a database. Mastery of laboratory research techniques. Developing self-education. Ability to operate GPR and interpret GPR images. Ability to work as part of a team.