

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

Project title:

Effects of the restoration method used after wind storm on characteristics of forest ecosystem after the disturbance

1.1. Project goals

So far, the studies in wind-damaged forest ecosystems have been conducted in the damaged in 2002 area in the Piska Forest (Rykowski 2012). Consequences of forest extensive disturbances have been investigated also in huge post-fire areas (np. Sewerniak 2010, 2016; Sewerniak, Mendyk 2015). In turn, until now, the detail environmental studies have not been conducted in the huge wind damage happened on August 11-12, 2017, in forests of central-western Poland (Chojnacka-Oźga, Oźga 2018), which has constituted the biggest abrupt disturbance occurring in Polish woodlands since the Second World War. Certainly, the studies in this area focused on the environmental effects of different management methods used after the wind damage can be crucial for sustainable restoration of damaged forest lands in the future. It has been highlighted that projected changes in temperature and precipitation (Knutti and Sedlacek 2013) would involve the increase in the risk of extreme events occurrence in European temperate forests in the next decades (Zell and Hanewinkel 2015).

Considering the above facts, the goal of this project is to recognize the effects of the restoration method used after wind storm on characteristics of forest ecosystem after the disturbance. The research will refer to both abiotic (properties of microclimate and soils), as well as biotic (growth dynamic of trees) components of the wind-damaged forest ecosystem. Thus, the obtained results would deliver important scientific and practical knowledge for usage of rational restoration methods in regeneration of wind damaged ecosystems in Central Europe.

1.2. Outline

To achieve the aim of the project research plots will be established in the wind-damaged on 11/12 August 2017 area, located in the western part of the Kuyavian-Pomeranian Voivodeship in Poland. The following differences in management are planned to be included in the research: 1) regeneration method of a forest stand (artificial vs. natural); 2) soil preparation method used before the regeneration (forest plough vs. forest tiller usage), 3) species composition of young plantation (pine stands vs. deciduous or/and mixed stands). For comparison purposes, the reference plot will also be established in the damaged forest stand which has been excluded from any forest management after the disaster in 2017. In the established plots studies on dynamics of microclimate (air humidity and temperature recorded by installed in a field automatically loggers) will be surveyed, as well as the soil properties being related to trees growth (texture, nutrients content, pH, stocks of soil organic matter, moisture), and growth dynamics of young trees will be examined. Certainly, the obtained results will be crucial for sustainable restoration of future wind-damaged forest areas. Hence, Polish State Forests has expressed the interest in the planned project. Thus, there is a fair chance that the research could receive some organizational and financial support from the company.

1.3. Work plan

The project will be realized from 2022 to 2026. The estimated terms of the main project phases are as follows:

- literature studies (2022-25),
- field works (microclimatic and soil studies, as well as trees measurements): 2022-25,
- laboratory analyses of the collected soil samples: 2022-25),
- analyses of the obtained results and elaboration of practical recommendations for sustainable forest management in the disturbed ecosystems: 2024-26,
- presentation of the results and writing PhD thesis: 2024-26.

Literature

- Chojnacka-Ożga, Ożga, 2018. Meteorological conditions of the occurrence of wind damage on August 11–12, 2017 in the forests of central–western Poland. *Sylvan* 162 (3): 200-208.
- Knutti R., Sedláček J., 2013. Robustness and uncertainties in the new CMIP5 climate model projections. *Nature Climate Change* 3: 369-373.
- Rykowski K., 2012. Hurricane in the forest. Disaster or disturbance? Pisz Forest District 4 July 2002 – a case study. Instytut Badawczy Leśnictwa, Sękocin Stary.
- Sewerniak P., 2010. Analysis of fire impact on some properties of pine forest phytocenosis in aspect of silviculture [in:] Sewerniak P., Gonet S.S. (eds.), *Environmental effects of forest fire*. Polskie Towarzystwo Substancji Humusowych, Wrocław: 83-107 (in Polish).
- Sewerniak P., 2016. Differences in early dynamics and effects of slope aspect between naturally regenerated and planted *Pinus sylvestris* woodland on inland dunes in Poland. *iForest - Biogeosciences and Forestry* 9: 875-882.
- Sewerniak P., Mendyk Ł., 2015. Secondary succession of trees in the dune landscape of the “Glinki” long-term research area – analysis with GIS. *For. Res. Pap.* 76,2: 122-128.
- Zell J., Hanewinkel M., 2015. How treatment, storm events and changed climate affect productivity of temperate forests in SW Germany. *Reg. Environ. Change* 15: 1531-1542.

1.4. Required initial knowledge and skills of the PhD candidate

A candidate should have experience in the conduction of environmental studies in forest ecosystems (e.g. academic thesis done in this field). She/he should have knowledge in the field of soil science and the functioning of forest ecosystems. Additionally, the following skills are required:

- high efficiency in field and lab research,
- ability of analytical analysis and interpretation of scientific results,
- basic knowledge and skills in the field of statistical analysis of the scientific results,
- ability to use a graphic software,
- ability to efficiently work alone as well as in a team,
- communicative Polish or/and English.

1.5. Expected development of the PhD candidate’s knowledge and skills

- knowledge on the functioning of disturbed forest ecosystems and on the methods used for

their restoration,

- ability to conduct field works focused on soil and microclimatic research, as well as on trees measurements,
- laboratory analyses of soil samples,
- ability to logically and synthetically analyse a forest ecosystem with reference to forest management,
- statistical analyze of the obtained results,
- introducing and discussion of the results in presentations, as well as in a text form.