How do seed limitation and negative density dependence shape the recruitment of native and invasive tree species?

The research objective of the proposed project is to evaluate whether invasive alien trees have advantage over native trees at the recruitment stage, and whether this advantage is mediated by the interaction with herbivores. To reach this goal we will perform both observational and experimental tests.

Invasive alien species are species that proliferate, spread, and persist outside their native distribution area. They can endanger the environment in the new area where they become "naturalized", for example by competing for resources with native species, altering habitat parameters, and reducing native species biodiversity and abundance. Invasive plants appear to be the group with major altering potential and trees, in particular, can act as "ecosystem engineers".

Naturalization is the process during which a species integrates into the new area, becoming capable of reproducing and growing on it. Recruitment is the successful establishment of offspring and is therefore a key stage in naturalization process. In case of trees, the adult plant needs to be capable of producing seeds, and these seed need to be capable of germinating, then turn into seedlings and saplings. Therefore, it is particularly important to conduct studies on recruitment stage.

A key hypothesis explaining the alien species advantage over native ones is the Enemy Release Hypothesis. It suggests that invasion success can be attributed to the lack of naturally co-evolved enemies in the invaded range. We will study three pairs of invasive alien vs species: red oak *(Quercus rubra)* vs pedunculate oak *(Quercus robur)*; ashleaf maple *(Acer negundo)* vs Norway maple *(Acer platanoides);* green ash *(Fraxinus pennsylvanica)* vs common ash *(Fraxinus excelsior)*.

We will use three most invasive alien trees in Central Europe. We will perform observational and experimental tests in field conditions. We will work at Leśny Zakład Doświadczalny ("Forest Experimental Institute") Murowana Goślina. For three years, we will measure seed production in red and pedunculate oak (to measure which one produce more seeds). We will sow seeds at different densities (to measure whether recruitment is limited by seed number), half of which will be protected from herbivores (to measure seed predation rates). We will plant seedling at different densities (to measure density dependant mortality), where again half will be protected from herbivores (to measure the role of herbivores in density-dependent mortality).

Finally, we will perform statistical analysis to see how these factors interact, and whether alien species advantage over native species is driven by enemy release. We predict that seed limitation and weak density dependence will magnify the effects of enemy release and boost the recruitment advantage of invasive trees over natives. This new knowledge will identify population processes responsible for species invasiveness and will inform invasive species management and control.