Large annual variation in seed production by plant populations synchronized over large areas is called ‘mast seeding’. This variation in reproduction initiates changes in ecosystems that perpetuate from granivores to their predators, and even ticks, and shapes the risk of Lyme disease and Hantavirus infection in humans. It has also important economic consequences as acorns are important food for livestock.

The mechanisms that causes the variability and synchrony in plant reproduction fascinate ecologists from decades. How does it happen that for years’ trees do not produce almost any seeds? And then, suddenly, all of them produce tones of seed per hectare, and they do that together, nonmatter if this particular oak tree grows near Poznań or Berlin? The basis of almost all ideas about these mechanisms are changes in pollination efficiency. Two basic models were so far developed. One is pollen coupling, i.e. density-dependent pollination efficiency that is driven by annual variation in flower production. In other words, when there is a lot of flowering trees in a particular area, the pollen transfer is high, and plants can produce a lot of seeds. Alternatively, through the pollination Moran effect, under which pollination efficiency is decoupled from the extent of flower production and environmental factors drive pollination failure. One idea here is that weather affects seed production through its effects on *flowering synchrony* and associated pollination efficiency. When the spring temperature is high, trees flower in synchrony which increases pollen availability. However, the support for these theoretical considerations is based almost solely on correlations. Therefore, to advance the field, we need experimental evaluation of the accumulating theory. Pollen coupling is central to masting models since it was introduced, however, it has been experimentally tested only in one system. Furthermore, the experimental support for pollination Moran effect it is virtually non-existent.

In the project, we will address the above-mentioned shortcomings. We will experimentally test whether mast seeding in oaks arises as a consequence of pollen limitation interacting with plant resource state. We will evaluate the mechanism of pollen limitation: whether it is driven by pollen coupling (i.e. density-dependent pollen limitation), by phenology synchrony (i.e. synchrony-dependent pollen limitation), or by both. Furthermore, we will cross the pollen addition experiments with resource manipulation to simultaneously test the role of both in driving mast seeding. Finally, we will construct empirically-parametrized, resource-based models of seed production for model trees. These will inform whether described processes are sufficient to produce dynamics of masting as seen in nature.

The project will provide not only one of the few experimental tests of pollen limitation in masting plants, but the first experimental test of *the mechanism* of pollen limitation: phenology synchrony or pollen coupling. Furthermore, by addressing simultaneously role of resources and pollen it will resolve the role of both in driving masting. The outcome of the project will have important consequences for mast seeding theory and evolutionary considerations of underlying masting mechanisms. Finally, the results of the project will provide insights into our predictions on how global warming will affects patterns of masting.