For decades, forest ecology has been mainly focused on plant growth and survival. Variation in seed production was largely ignored and forest models often assumed that seeds remain available even when adults are absent. Yet, the long-term stability of forests depends on tree reproduction, which creates the next generation of plants and determines the composition of future communities. What is more, in numerous tree species seed production varies strongly among years. In some years tree species reproduce prolifically and in sync, creating a bounty that will reverberate through the ecosystem for years. Such a year of an extremely high crop is called a "mast year". Mast seeding is very often synchronized over large areas, up to thousands of kilometers. This variation introduces pulses of resources into ecosystems that magnify through food webs and has important consequences, both ecological (e.g. dramatic changes in abundance of granivores) and socioeconomic (e.g. affects Lyme disease risk in humans by influencing the number of disease-transmitting ticks). The phenomenon attracts significant scientific attention but basic questions concerning the nature of masting remain unresolved.

In the project, we will untangle the role of resource dynamics in driving forest reproductive patterns on Earth – including in fecundity and in masting. To achieve this, we will use a global database of annual tree level seed production patterns that includes more than 12,000,000 observations and FACE experiment, a long-term resource manipulation of CO2 and nitrogen levels in a boreal forest. The main outcomes will include the experimental description of how masting changes under elevated resource levels. Moreover, we will provide the first explicit test of how variation in resource levels drives fecundity and masting patterns on a global scale. Our work will deliver a step-change in identifying processes responsible for global variation in forest reproductive patterns, both among and within species. How tree reproduction responds to climate change will determine the structure and diversity of 21st century forests, the function of food webs, and ecosystem services important for human welfare. The unpredictable recruitment of trees has emerged as a key obstacle to understanding forest change and the consequences for mast consumers. Mechanistic understanding of the reproductive patterns of trees is the first step that will allow predictive distributions of recruitment potential of trees and food availability for consumers as habitats change.