Project Summary

There is growing recognition of the importance of plant-soil interactions for plant population dynamics and community interactions. Both positive and negative feedbacks may occur where soil microbiota either favor the survival and growth of a particular species or actively inhibit it. Negative feedback has recently been documented between the temperate tree species, black cherry (*Prunus serotina*), and soil-borne fungal pathogens in the genus *Pythium* that inhibit seedling establishment in the vicinity of adult trees, in accordance with the Janzen-Connell hypothesis. The objectives of the proposed research are to 1) determine how negative feedback between black cherry and *Pythium* changes with successional age of the community and the age of individual trees, 2) assess the degree of host specificity of *Pythium* species causing damping-off in black cherry and 3) evaluate whether other temperate tree species are affected in a similar way by soil-borne pathogens.

Black cherry seedling survival around adult trees will be monitored in field quadrats located in early, mid and late successional sites, and in adjacent quadrats where seeds will be planted at fixed densities. In parallel, survival of seedlings in unsterile versus sterilized soil sampled beneath extant black cherries at each successional stage will be evaluated in greenhouse experiments. The degree of host specificity of *Pythium* species isolated from black cherry will be explored in laboratory and greenhouse experiments. Water agar plates with sterile black cherry seedlings, seedlings of other species, or mixtures of both will be inoculated with *Pythium* isolates and fungal growth will be monitored. Analogous inoculation experiments also will be conducted with seedlings grown in sterile soil. *Pythium* DNA sequence data will be used to examine variation among *Pythium* isolates and to identify species. The potential for negative feedback in other temperate trees will be determined by growing seedlings of ten species in sterilized versus unsterile field soil collected beneath adults. For species with significantly enhanced survival in sterilized soil, seedling survival in field quadrats will be measured, as will survival in adjacent quadrats planted with a fixed density of seeds. Fungal isolates will be obtained from roots of dying seedlings for identification. Finally, to determine if species exhibiting negative feedback in greenhouse and field trials also exhibit greater dispersion in the field with increasing size or age, individuals of those species greater than 2cm dbh will be mapped in one hectare blocks and the spatial aggregation of different age classes will be analyzed.

The proposed research will explore the role of soil-borne pathogens as regulators of seedling establishment, spatial dynamics and successional change within temperate forest communities. It will provide valuable comparative data with results from tropical forests, and will have practical applications for forest and orchard management, and ecological restoration. The ability to isolate, culture and inoculate soil pathogens allows for rigorous experimental tests of mechanisms creating spatial patterns of tree recruitment.