ABSTRACT

THE LOCAL NEIGHBORHOOD INTERACTIONS SHAPING TREE COMMUNITIES THROUGH ECOLOGICAL DISTURBANCE AND ENVIRONMENTAL CHANGE

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My dissertation consists of four chapters focused on understanding the factors maintaining local species diversity. This focus addresses a central goal of ecology that is increasingly critical to preserving ecosystem services and human well-being in the face of climate change. Specifically, I investigate how local neighborhoods – that is, the spatial arrangement, density, and identity of nearby competitors – contribute to patterns of growth and survival along gradients of ecological disturbance and environmental change using forest tree communities as a study system.

In my first chapter, I examine why we may expect neighborhood interactions to weaken under different types of ecological disturbances that primarily affect competitive densities or nutrient availability. This chapter provides a conceptual framework for understanding how disturbance-altered neighborhood interactions influence forest recovery and forms the foundation for my remaining chapters.

For my second and third chapters, I examine the neighborhood interactions of two dominant conifer species in Pacific Northwest: *P. menziesii* (Douglas-fir) and *T. heterophylla* (Western hemlock) across life-stages and environmental conditions. First, I demonstrate that wildfires disrupt neighborhood interactions between seedlings and surviving adults that are otherwise thought to stabilize local populations in undisturbed ecosystems. Then, I use dendrochronology to assess how neighborhood interactions have influenced 60 years of climate-growth relationships in large adult trees, finding species-specific effects of neighborhood interactions on growth responses to temperature and precipitation.

Finally, my fourth chapter tests an important driver contributing to shifts in neighborhood interactions in changing environments: the soil microbiome. This chapter presents the stress-gradient feedback hypothesis, which posits that increasing environmental stress should increase the benefits of relatively host-specific facilitation relative to antagonism. In support of this hypothesis, I demonstrate that pathogenic fungi are more associated with tree communities at low elevations, which have stronger stabilizing neighborhood interactions, whereas ectomycorrhizal fungi are more associated with tree communities at high elevations, which have weaker stabilizing neighborhood interactions.

Collectively, this dissertation advances our understanding of how stressors associated with ecological disturbance and environmental change alter the local interactions thought to contribute to maintaining diverse communities, with implications for predicting forest community responses to climate change and climate-altered disturbance regimes.