CHAPTER 12.

Impacts of Laurel Wilt Disease on Native *Persea* Ecosystems

(Project SO-EM-B-12-05)

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INTRODUCTION

Although mostly occurring as associate tree species in forest communities, *Persea* has a wide native distribution in southeast coastal plains (Shearman and others 2015). Laurel wilt disease (LWD) is a lethal vascular infection of trees in the laurel family (Lauraceae) caused by the fungus *Raffaelea lauricola* (Fraedrich and others 2008). The fungus is vectored by a nonnative ambrosia beetle (*Xyleborus glabratus*), which was first recorded in the United States in 2002 (Rabaglia and others 2006). Laurel wilt disease was first reported in 2003 in redbay (*P. borbonia*), and has since spread throughout *Persea* populations in South Carolina, Georgia, and Florida, as well as parts of North Carolina and small pockets of Mississippi and Alabama (fig. 12.1) (Shearman and others 2015). Laurel wilt disease infestation often causes near 100 percent mortality of *Persea* stems, but it also affects sassafras and avocado. The objectives of this project were to document the rangewide population impacts of LWD, to describe community types associated with *Persea*, to characterize the patterns of mortality and regeneration of *Persea* after infestation, and to quantify changes in fuel and invasive plants.

METHODS

We used Forest Inventory and Analysis (FIA) data (Reams and others 2005) from the Forest Service, U.S. Department of Agriculture, to estimate *P. borbonia* populations from 2003 to 2011 to see if any decline could be observed since the introduction of the LWD causal agent. We developed a logistic regression model to predict the probability of redbay mortality due to LWD.

To document the stand characteristics of redbay and swamp bay (*P. palustris*) communities, we analyzed data collected from 1988–2012 by the Carolina Vegetation Survey (Peet and others 1998). We used cluster analyses and species indicator analyses to group 388 plots into distinct communities.

To study the response of communities after LWD, we surveyed 61 plots from 1 to 10 years post-LWD on nine sites in South Carolina and Georgia (fig. 12.2). On each plot, we also sampled woody fuels to see if LWD had any implications on fire behavior. However, because LWD kills nearly all *Persea* in a stand and spreads rapidly from stand to stand, we did not have adequate control plots in the same stands as

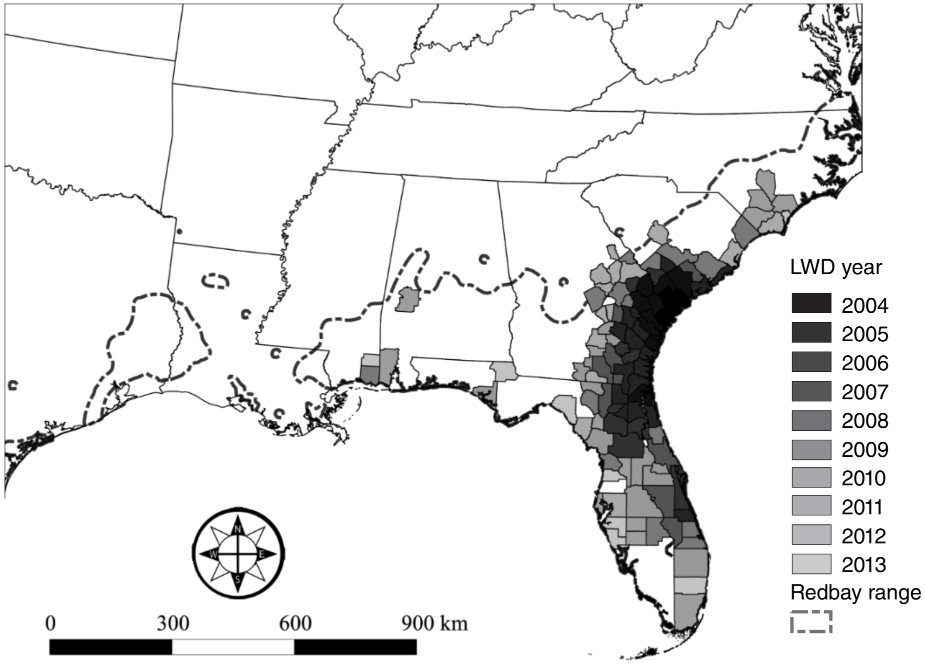

Figure 12.1—Geographic range of redbay (dashed line) in the Southeastern United States (Brendemuehl 1990). Shaded counties represent the spread of laurel wilt disease (LWD) as of August 2013 (USDA Forest Service, Forest Health Protection, Southern Region 2013). Darker shades indicate earlier years of reported infection.

infected plots. We therefore focus on comparing fuel loading among recovery years using analysis of variance.

RESULTS AND DISCUSSION

The trend line for the rangewide population estimates from 2003–2011 showed significant negative curvature, suggesting that the redbay population is declining. The population in Georgia significantly decreased from approximately 241.1 ± 11.9 million stems in 2003 to 150.3 ± 7.9 million in 2011. Redbay densities decreased significantly in plots surveyed before and after the reported infection by an average of 89.6 live redbay stems/ha. Number of years since LWD infection was the most significant variable, with every increase in 1 year resulting in a 153.7 percent increase in

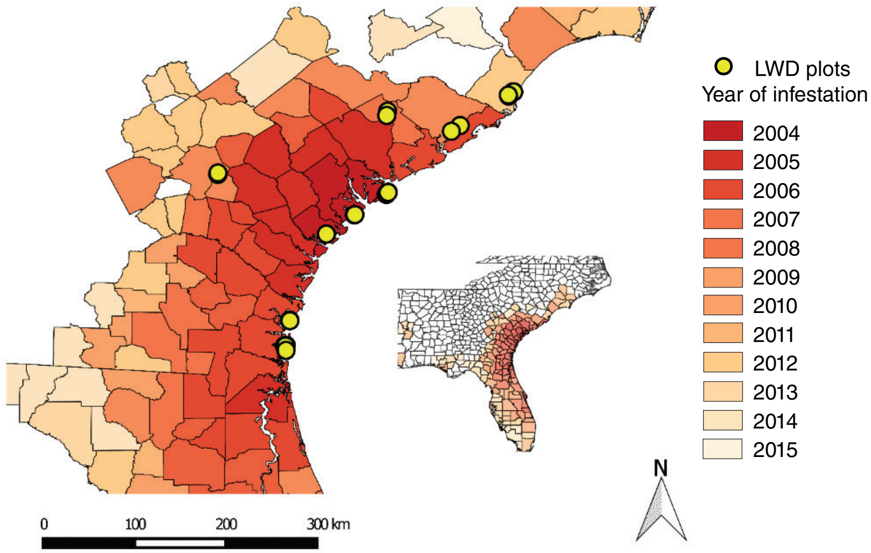

Figure 12.2—Location of 61 sampled plots on nine sites along the coast of South Carolina and Georgia. Laurel wilt disease infestation data obtained from Hughes and others (2015).

odds of death. Diameter was also a significant predictor, with an increase of 1 cm diameter at breast height (d.b.h.) resulting in a 5.0 percent increase in odds of death.

Our community analysis indicated that redbay and swamp bay communities were significantly different in species composition. In addition, redbay was almost exclusively limited to maritime coastal forests, whereas swamp bay had a significantly larger geographical range, extending from near coastal settings inland through the fall-line sandhills.

We did not find evidence of invasive species abundance increasing after LWD. Nearly all *Persea* in a plot are killed within the first two years of LWD, with the exception of smaller stems < 2.5 cm in diameter. After 10 years, *Persea* had regained much of the basal area prior to infection; however, the structure of the stands was predominantly composed of small diameter stems (1–5 cm d.b.h.). Seedling densities remained relatively the same throughout all recovery years. Although we detected differences in 1-hour fuels, litter, and duff among recovery years, it is likely that these differences are due to factors other than LWD. Initial attempts at preventing the spread of the disease, such as removing and burning symptomatic stems, have also likely impacted the fuel loadings in our study. We therefore cannot conclude that LWD has increased the risk of high intensity fires.

CONCLUSIONS

Contrary to initial fears, this study suggests that the native *Persea* species in the United States are not on the immediate verge of extinction from LWD at this time. However, it is still too early to say whether these species will fully recover from the disease. Whether *Persea* recovers completely hinges on the ability of *X. glabratus* to maintain low populations in the long term. We predict one of four possible futures for *Persea* species: (1) the species will continue to decline, failing to regenerate, to the point of extinction; (2) both species will recover, either by *X. glabratus* populations declining due to lack of sufficient host material or by the propagation (natural or assisted) of wilt-resistant individuals; (3) *X. glabratus* will maintain small populations resulting in *Persea* occurring perpetually as small diameter stems; or (4) a cyclical pattern will emerge as *Persea* recover, are attacked and decimated, and recover again. Future long-term studies that monitor recovery in *Persea* species as well as beetle populations will be able to test these hypotheses.

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