

INTRODUCTION

Heterobasidion root disease (*Heterobasidion irregulare*; HRD) causes substantial pine (*Pinus* spp.) mortality in North America and other regions of the Northern Hemisphere. It first appeared in Wisconsin in 1993 and has since been documented in 28 counties. It was first documented in Michigan in 1963, and recent survey work found it was present in 19 counties. New infestations mainly occur when spores carried by wind land on freshly cut pine and spruce (*Picea* spp.) stumps. Expanding mortality gaps develop as the fungus spreads along interconnected roots. Treating cut conifer stumps with a fungicide effectively prevents HRD infestation.

The continued spread and impact of HRD in the Lake States has increased awareness and concern about the disease. Recent research has filled some knowledge gaps, but many questions are yet to be answered. One knowledge gap in the Lake States is determining what species naturally regenerate in pine plantations infested with HRD. The objective of this research was to evaluate the composition of natural regeneration in red pine (*P. resinosa*) stands impacted by HRD in Wisconsin and Michigan.

METHODS

Thirty-one sites in Wisconsin and Michigan with known HRD infestations were assessed. *H. irregulare* was confirmed via laboratory cultures for all sites. Forty-nine expanding mortality gaps were studied across the 31 sites (three or fewer per site). Expanding mortality

gaps were typically not concentric and varied in size from 0.02 to 8.5 acres with a mean of 0.96 acres. All understory regeneration was evaluated in three 10-m² round plots for each expanding mortality gap. The species and height class (0.6-m intervals) were recorded for every plant in the plots. “Desirable” regeneration included aspen (*Populus tremuloides*), balsam fir (*Abies balsamea*), black cherry (*Prunus serotina*), jack pine (*P. banksiana*), oak (*Quercus* spp.), red maple (*Acer rubrum*), red pine, white pine (*P. strobus*), and white spruce (*P. glauca*). “Undesirable” regeneration included boxelder (*A. negundo*) and three invasive plant groups: barberry (*Berberis thunbergii*), buckthorn (*Frangula alnus* and *Rhamnus cathartica*), and honeysuckle (*Lonicera* spp.).

Overstory tree species were recorded in variable radius plots (10 BAF [basal area factor] prism; square feet) 10 m and 100 m in each cardinal direction from the edge of expanding mortality gaps. See Demchik and others (2020) for full methods including statistical analyses.

RESULTS

The majority of expanding mortality gaps had sufficient desirable regeneration to fill them over time (Demchik and others 2020). Regeneration was a mix of hardwood and conifer species (Demchik and others 2019) (figs. 8.1 and 8.2). Woody invasive plants were discovered on 39 percent of sites (Demchik and others 2020). Red maple or oak in the overstory 10 m from a gap were correlated with more regeneration of that species in the understory (Demchik and others

CHAPTER 8.

Determining What Species Regenerate in Forest Stands Impacted by Heterobasidion Root Disease in Wisconsin and Michigan

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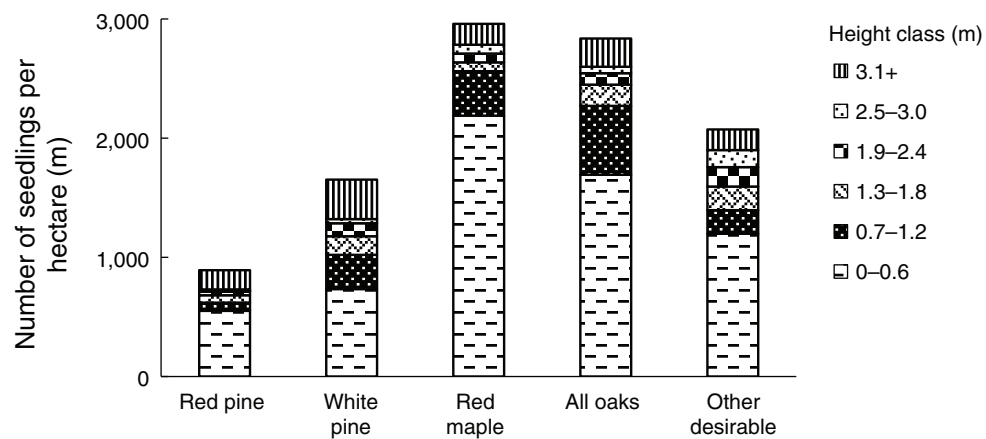


Figure 8.1—Regeneration in Heterobasidion irregulare-caused expanding mortality pockets or gaps (number of seedlings per hectare by height class) in Wisconsin and Michigan.

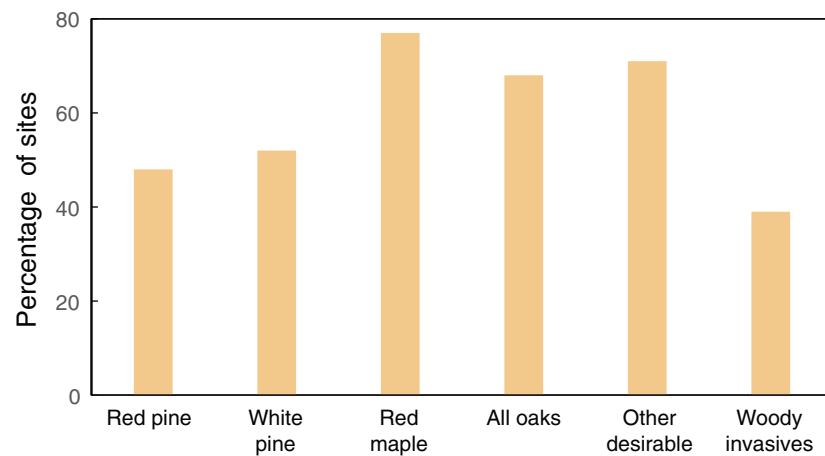


Figure 8.2—Percentage of sites in Wisconsin and Michigan that included each species or species group.

2020). Basal area, soil type, and gap size also impacted regeneration of some species (Demchik and others 2020).

DISCUSSION AND CONCLUSIONS

Although most gaps had satisfactory levels of desirable regeneration, a considerable amount was of HRD- susceptible conifer species. We predict that impacts to pine regeneration may increase as seedlings become saplings and their root systems have a greater chance of contacting HRD-infected trees, stumps, or spores in the soil. Pine regeneration is currently considered desirable because the impacts of HRD on pine regeneration over time in the Lake States still needs to be studied. Nonetheless, because HRD can remain active on infested sites for decades, we expect that these pine stands will increasingly become dominated by hardwood species that are not impacted by HRD. Forestry professionals should be consulted to determine what species of regeneration are most appropriate for an infested site. Management recommendations will vary depending on how many HRD infection centers exist in a pine stand. The quantity of invasive plants will also impact management recommendations. In highly infested stands, regenerating to pine species is not advised; therefore, additional management that converts the stand away from pine may be necessary. These changes in species composition are likely to impact the ecology and economic value of HRD-infested stands. For HRD management recommendations, see Wisconsin's

guidelines for stump treatment to reduce the risk of introduction and spread of Heterobasidion root disease (Wisconsin DNR 2020).

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LITERATURE CITED

- Demchik, M.C.; Sakalidis, M.L.; Hillstrom, M. [and others]. 2020. Evaluating regeneration in Heterobasidion root disease infested stands in the Lake States. *Forest Science*. 66(2): 141–144. <https://doi.org/10.1093/forsci/fxz074>.
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