Integrating Biological and Social Science to Assess Management Success of an Exotic Invasive Tree Pathogen

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Introduction

The oak wilt fungus, *Ceratocystis fagacearum*, is an introduced invasive pathogen and poses a serious threat to red oaks, *Quercus* spp. Section Lobatae, in Minnesota (Fig . 1). This exotic invasive forest pathogen is of concern in Minnesota due to the current and potential detrimental impacts on deciduous forest ecosystems in rural and urban landscapes (Fig 1). The Minnesota Department of Natural Resources (MN-DNR), in cooperation with USDA Forest Service, implemented a risk management program to fund local government action aimed at suppressing oak wilt and preserving existing oak trees. Nevertheless, oak wilt continues to spread. To better understand the factors influencing the long-term success of oak wilt management in Minnesota, we asked three questions:

Study Questions

1. How effective are current oak wilt management programs in Minnesota?
2. Do managers perceive oak wilt as a priority invasive species threat?
3. How do institutional factors influence effectiveness of Oak Wilt management?

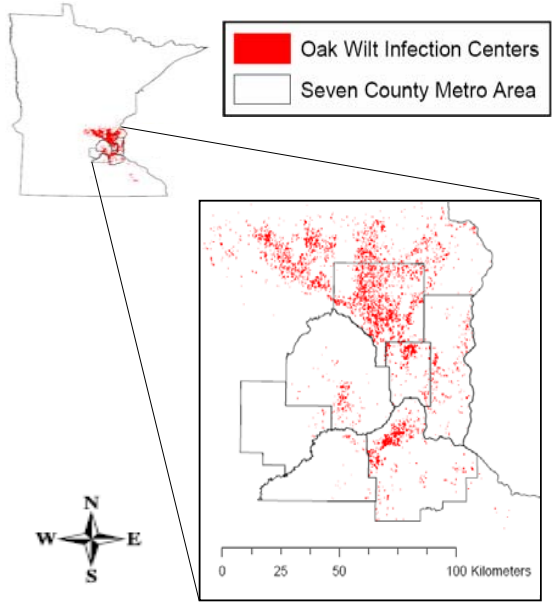

Figure 1. Distribution of oak wilt infection centers in the seven-county Twin Cities metro area in Minnesota.

1. Efficacy of Treatment

How effective are current oak wilt treatment options in Minnesota?

Methods

Of 1138 sites treated for oak wilt in 2004, 129 were checked for efficacy in 2007. Efficacy was defined as no new oak wilt infections detected 20.1 m beyond the original infection center (see Fig . 2 for treatment options).

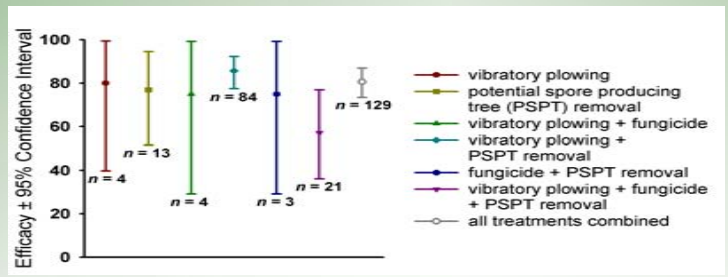

Figure 2. Efficacy (± 95% confidence interval) of each management program represented in the 2007 efficacy check. Overall efficacy was determined by combining results from all management programs.

Results

- Vibratory plowing + PSPT removal was most effective in controlling local spread of oak wilt with an 86% efficacy rate (Fig. 2).
- We estimate that 81% of treatments in Minnesota in 2004 would have been effective based on efficacy estimated for each management program.

2. Management Priority Setting

Do managers perceive oak wilt as a priority invasive species threat?

Methods

We conducted 16 semi-structured interviews with state foresters (n=8) and municipal tree managers (n=8) with oak wilt in their management areas. Participants were randomly selected and interviews were conducted in person and over the phone.

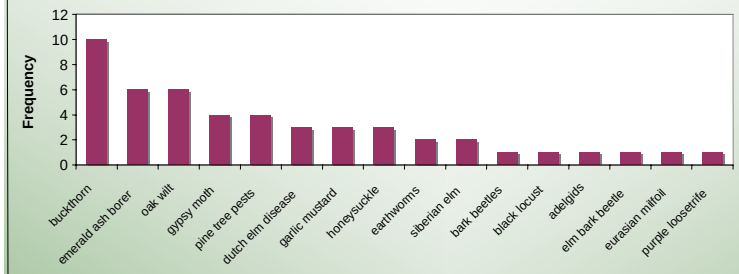

Figure 3. Invasive species identified as top managerial concerns

Results

- Overall, invasive species were the highest priority threat.
- Oak wilt was one of the most important invasive species threats (Fig. 3).
- Perception of the oak wilt threat is not consistent among managers. On a scale of 1 (no threat) to 5 (highest priority threat), managers ranked oak wilt as everything from 1 to 5. The mean ranking was 3.4 with a variance of 1.6.

3. Institutional Factors

How do institutional factors influence effectiveness of Oak Wilt management?

Methods

We performed 13 in-depth, semi-structured interviews with foresters and private contractors at the city and county level. The interviews provided information on the oak wilt management programs of 16 cities and 3 counties (19 total communities).

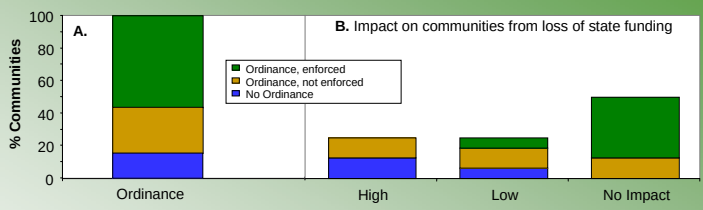

Figure 4. Percentages of communities with oak wilt management ordinances, ordinance enforcement mechanisms, and the impact of loss of state funding on the communities.

Results

- Of the communities with ordinances requiring PSPT removal (84% of total), only 56% enforced tree removal (Fig. 4a) due, in part, to program resource constraints and local concerns over the economic burden on landowners, especially in the absence of matching grants.
- 25% of communities interviewed reported that a loss of state funding would highly impact their management program (Fig. 4b).
- 75% of communities not impacted by a loss of funding have established and enforce a PSPT removal ordinance (Fig 4b).

Conclusion

Oak wilt has traditionally been viewed by scientists and policy makers as a serious invasive species threat that can be managed with appropriate technical control measures. Our research provides evidence of the effectiveness of control measures, which can inform/improve managers' future efforts. However, our research also discovered a larger societal debate over how much of a threat oak wilt represents, as well as how institutional issues constrain and facilitate control efforts. Understanding the social *and* biological complexities of oak wilt will help inform how the MN-DNR and USDA Forest Service designs and implements control programs, improving overall risk management of oak wilt.

ACKNOWLEDGEMENTS

We would like to extend a special thanks to Susan Burks, Val Cervenka, and Ed Hayes with the Minnesota Department of Natural Resources, Jill Pokorny and Jennifer Juzwik with USDA Forest Service, and the numerous individuals who met with the students to share their opinions and experiences about oak wilt. These interactions enriched the educational experience. The IGERT program on Introduced Species and Genotypes (ISG-IGERT) provided funding for this project.