

# Assessment of the Rate of Progression of Butternut Canker in Vermont

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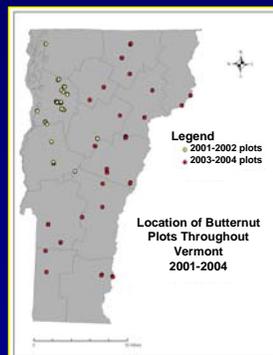
## Introduction

The butternut canker fungus (*Sirococcus clavignenti-juglandacearum* Nair, Kostichka, and Kuntz) (SCJ) is believed to be an exotic pathogen that has seriously impacted butternut (*Juglans cinerea*) throughout its range in eastern North America. In the Northeast, limited information is available on the health status of butternut because this species is not significantly represented in the national forest health monitoring (FHM) network of plots.

During 1993-96, Vermont established 18 permanent plots, evaluated 1317 butternut trees, and found 94% were cankered and mortality was 12%. Reduced crown vigor and secondary pathogens (esp. *Armillaria* sp.) were associated. Vermont's permanent database is a valuable resource for monitoring butternut canker incidence and severity and rates of tree mortality over time. This information helps to better understand butternut canker and to develop new guidelines for management of butternut.

## Methods

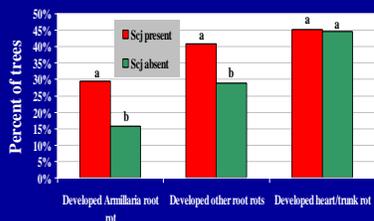
All trees were recorded by GPS location and included in a GIS database. Individual tree information included: DBH, height, crown class, crown diameter, and data on crown condition per FHM guidelines, epicormic branching, root and stem cankering, and presence of rot. All trees in the original data set were re-evaluated, and new plots and trees were added (2001-04) to assess butternut health in all counties of Vermont.



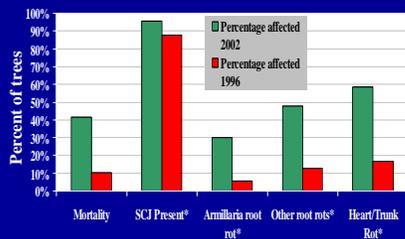
## Results

On re-evaluation of original permanent plots, SCJ infection and butternut mortality had increased to 96% and 41%, respectively, by 2002. Trees that exhibited main stem and root cankering in 1996 were more likely to be dead in 2002 and have *Armillaria* root rot and other root rots when compared to healthy trees, especially in understocked stands. Suppressed trees were most likely to die, but dominant trees had highest rates of root and trunk rots.

Comparison between SCJ-positive and SCJ-negative living butternut trees (1996) developing *Armillaria* root rot, other root rots and heart/trunk rots during the interim period 1996-2002. Letters indicate significant differences at 0.05 level.



Percent change (1996-2002) in butternut mortality, SCJ infection, *Armillaria* root rot, other root rot, and heart/trunk rot in northcentral Vermont.

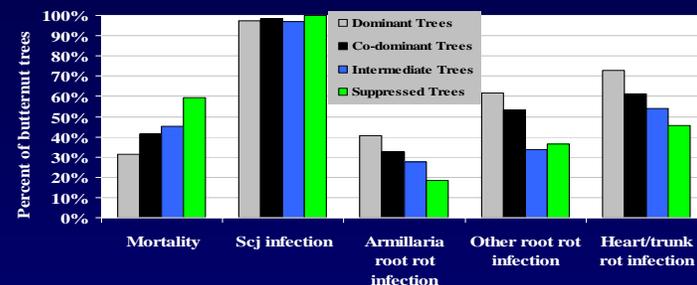


\* Data apply to trees living in 2002 only

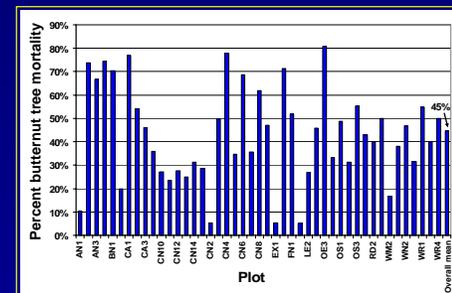
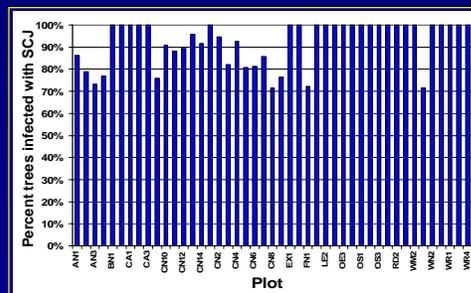


A diseased butternut with extensive dieback and epicormic branching in northern Vermont.

Comparison of 2002 mortality, SCJ infection, *Armillaria* root rot, other root rot, and heart/trunk rot rates classified by crown class. Differences among crown classes in mortality, other root rot, and heart/trunk rot were significant at the 0.05 level.



During 2003-2004, an additional 24 plots (1054 trees) were assessed. All trees were found infected, and mortality was 49% (range 5-81%, mean 44% on a plot basis). Combining all 45 plots (2325 trees) throughout Vermont, overall SCJ infection and butternut mortality levels were 86 and 45% respectively (2001-04 data).



## Conclusion

Butternut canker is increasing mortality of butternut in Vermont. The occurrence of secondary pathogens is further reducing tree health leading to premature mortality. Based on our mortality prediction curve, about 85% of all butternut trees in Vermont are expected to die by 2011. We must make an effort to retain and conserve all healthy appearing trees that may form the foundation for future selection and breeding programs designed to restore butternut to the eastern hardwood forest.

Projected mortality of butternut in Vermont based on 1996 and 2002 data. Mortality prediction given by equation  $Y=mX+b$ , where  $Y$ =estimated percent mortality at time  $X$  (in years from 1996),  $m$ =slope of the line (0.04833), and  $b=0.12$ .

