

POST-INVASION FORESTS: COMPOSITION AND STRUCTURE FOLLOWING INVASIVE SPECIES ESTABLISHMENT – YEAR 3 PROGRESS

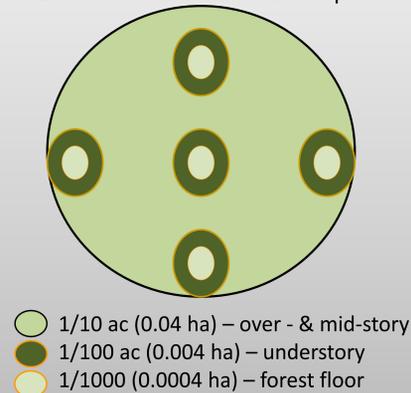
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INTRODUCTION Exotic pests pose a constant threat to forest health and forest sustainability in Kentucky and throughout the southeast. Emerald ash borer (EAB), thousand cankers disease (TCD), and laurel wilt disease (LWD) are non-native forest pest threats of current concern. Given the prevalence of susceptible host material, our post-invasion forests will clearly differ in composition and structure from their pre-invasion counterparts. We are evaluating these differences, and addressing data gaps associated with insect and disease risk models. We are documenting baseline conditions and using simulations to predict changes in the composition and structure of deciduous forests following establishment of specific invasive species in the southern Appalachian region, focusing on EAB, TCD, and LWD. This approach has been used successfully to simulate changes in composition and structure due to outbreaks of native and non-native pests.

METHODS We have censused forest vegetation to assess current conditions in relevant forest types, and are using these vegetation assessments to predict the outcome of invasion, establishment, ensuing interactions, and future forests. We used USDA FS FIA data to locate suitable resources, and then censused the woody plant community using established protocols (NRIS, FS Veg, CSE) in 0.04 ha (1/10 ac) fixed radius plots (n=3 plots/stand) (Fig. 1). Woody plants were identified, and average age, height, diameter, basal area, spacing and radial growth were measured. Canopy structure, ground surface cover, slope, slope position, elevation, and aspect were assessed. Woody plant abundance, diversity, and richness is computed for each plot. Using FVS, we are modeling species-specific and age-specific mortality/removal to simulate the effects of EAB, TCD, and LWD on forest composition and structure.

Fig. 1. Woody plant vegetation censusing using USDA FS Common Stand Exam protocol



PROGRESS Forty forest stands in 14 counties were censused in 2010. 15 stands in five counties were re-censused in 2011. 27 additional stands in 9 counties were re-censused in 2012, producing a 3 year continuous data set of 12 stands. Canopy composition was averaged across plots within each county to determine the applicability for modeling the outcome of invasions of EAB, TCD and LWD. We focused on ash stems for modeling EAB, walnut or butternut resources for TCD, and sassafras occurrence for LWD. We now have suitable baseline data to model all three species of interest.

FVS MODELING Vegetation data is being used to model forest stand succession using the southern variant of FVS, which is most relevant for our region. FVS uses vegetation data (DBH, height, crown height, crown class, average stand age, tree growth), forest landscape characteristics (elevation, aspect, slope, and slope position), and stand structure to model existing tree data, and to project future stand conditions on a 5 yr cycle, up to 50 yr. We are modeling species-specific and age-specific mortality/removal to simulate mortality from EAB (Figs. 4, 5), TCD, and LWD.

EMERALD ASH BORER All North American *Fraxinus* are susceptible to EAB, and attack is usually fatal (Fig. 2). Since its arrival in Kentucky in 2009 27 counties have been quarantined (Fig. 3). EAB has been reported in 19 of these counties, and our censusing efforts focused in this area. All counties censused have an overstory ash component (>5" dbh) of 13-77%, making them suitable for FVS modeling to simulate EAB-induced ash mortality and to predict subsequent changes in forest composition and structure (Figs. 4, 5).



Fig. 2. EAB is an exotic phloem feeder; attack is usually fatal

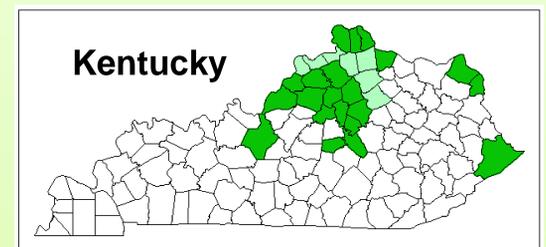


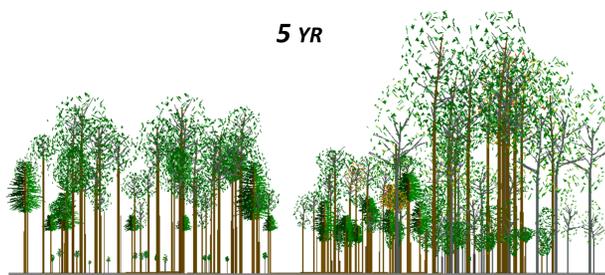
Fig. 3. EAB quarantined area in Kentucky

THOUSAND CANKERS DISEASE TCD is an insect-associated pathogen complex of walnut prevalent in western states. It has been reported in four eastern states (TN in 2010, VA and PA in 2011, NC in 2012). Our censusing efforts have yielded six counties with an overstory walnut component (>5" dbh) >2%, making them suitable for FVS modeling to simulate TCD-induced walnut mortality and to predict subsequent changes in forest composition and structure. Modeling efforts are under way.

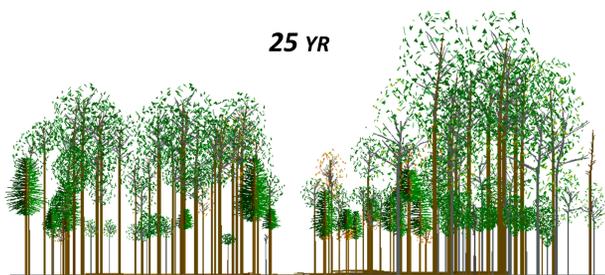
LAUREL WILT DISEASE The pest complex responsible for LWD has not been found in Kentucky, nor is its primary host, redbay. But the alternate hosts, sassafras and spicebush, are prevalent, suggesting that LWD could impact our forests. Nine plots had sassafras adequate (>2%) to include in our simulations.

EAB-FREE FOREST

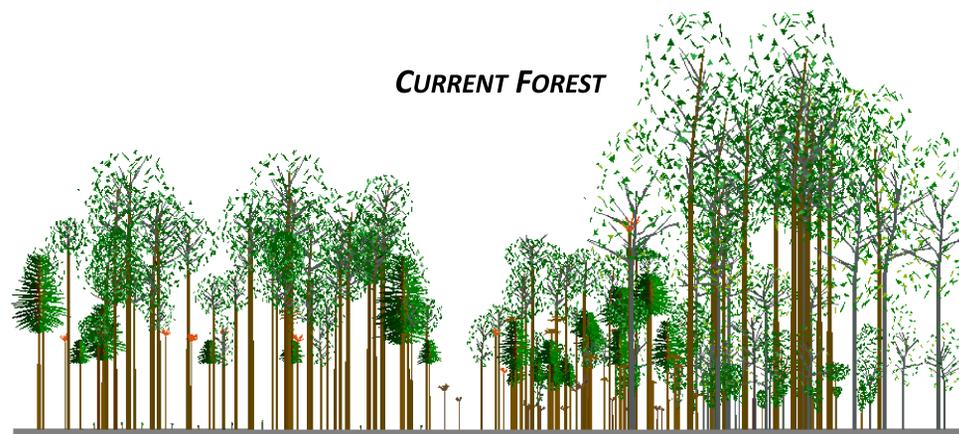
5 YR



25 YR

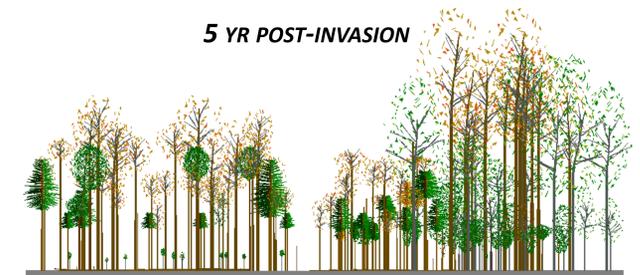


CURRENT FOREST



EAB-INVADDED FOREST

5 YR POST-INVASION



25 YR POST-INVASION

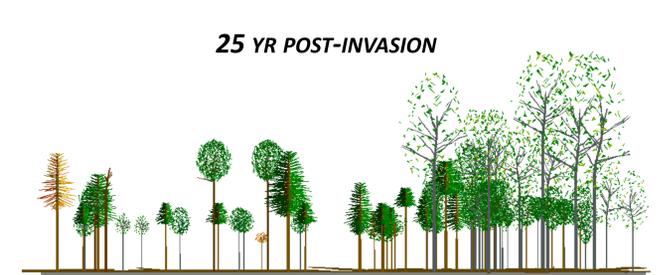


Fig. 4. FVS simulation of forests free of EAB

Fig. 5. FVS simulation of 99% ash mortality due to EAB invasion